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FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES WORLDWIDE

OCTOBER 15, 1988

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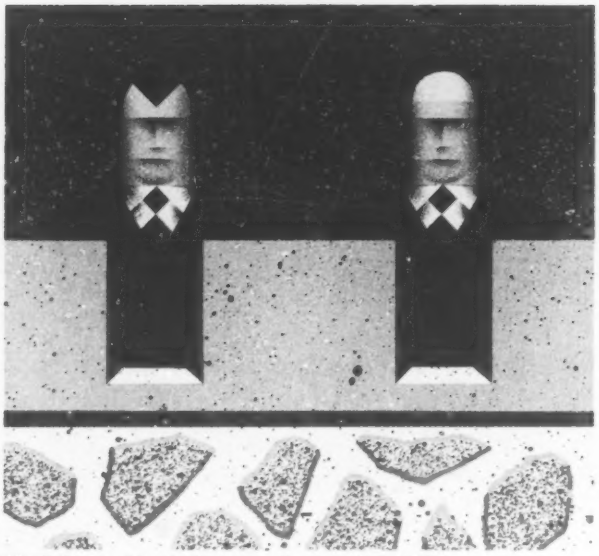
Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES—WORLDWIDE

VOL. 14, NO. 20 OCTOBER 15, 1988



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38 Inside the fortress: Europe after 1992

With the so-called "United States of Europe" less than four years away, many European electronics companies worry that free trade within the Common Market alone may not be enough. They realize that they must expand worldwide sales volume to achieve the economies of scale necessary to finance high-technology growth. For American electronics firms, the time to start mapping corporate strategy for the pending new era of European market integration is here. And the approaches are varied.

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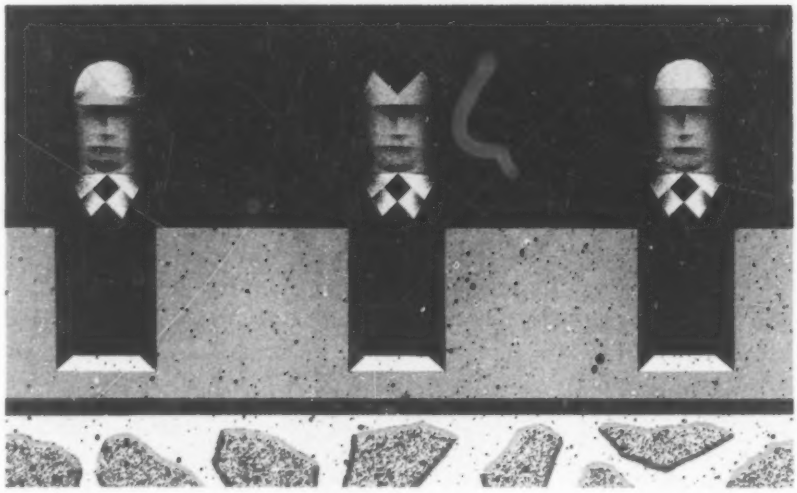

Euro-tactics

Back in the early 1970s, when the idea of a common European economic market was first put into practice, the vision was of a true "United States of Europe," an economic titan that would easily match the commercial might of the United States and Japan.

But until recently, there's been little prospect of that happening. From the business point of view, the European nations have remained a fractious, narrow-minded lot, always more ready to expand national trade interests than to pull for the greater good of the European Economic Community.

Now, though, that appears to be changing very fast. A whole new set of EEC trading rules is being enacted for a deadline of 1992 — rules that are not merely sweeping aside trading barriers between, say, France and West Germany, but which will radically change the global business picture for electronics companies.

Consider this: that the wave of mergers and acquisitions washing through Europe's electronics industries — Plessey taking over Ferranti's chip business, SGS and Thomson merging, to name just two — will leave a nest of industrial giants with the strength to defend their own markets and attack others like never before. That U.S. and Japanese companies may need to think again if they think they can raise all the necessary funds for their European operations in the City of London. That major Euro-traders like IBM will find it easier than ever to sell without the costly and time-consuming need to warehouse all across the continent.

The outcome of Europe 1992 — whether it protects Europe's markets or leaves them wide open — is by no means certain, as contributing editor Sherry Buchanan explains in our special European section. She did find, though, that those already "inside" — and that includes non-Europeans — will have a clear competitive edge. Those who aren't, who don't bother finding out how to deal with the new single market, are likely to lose out. To help U.S. electronics firms not yet doing business "over there," contributing editor Marty Chase provides a guide to some of the shortcuts.

JOHN KERR, managing editor

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Network nerve: OEMs team to help OS/2 topple NetWare

Should LAN vendors and their suppliers take sides in the battle brewing over OS/2-based PC networks? It may depend on which way IBM jumps

A battle is brewing in the local area networking world, as a number of OEMs prepare to introduce products based on a new network operating system.

Jointly developed and marketed by Microsoft Corp. of Redmond, Wash., and Santa Clara, California-based LAN vendor 3Com Corp., the new system — called the Microsoft OS/2 LAN Manager — aims to exploit the potential of networked personal computers running the OS/2 operating system. It also aims to displace Novell Inc.'s NetWare software as the network operating system of choice for connecting personal computers.

At stake is the lion's share of a burgeoning LAN marketplace. By the end of 1987, the U.S. installed base of PC LANs was worth about $3.5 billion, according to Kim Myhre, vice president for research and consulting at the Business Research Group, a Cahners Publishing Co. subsidiary. Myhre expects 1988 LAN shipments to add $1.5 billion of value to that base.

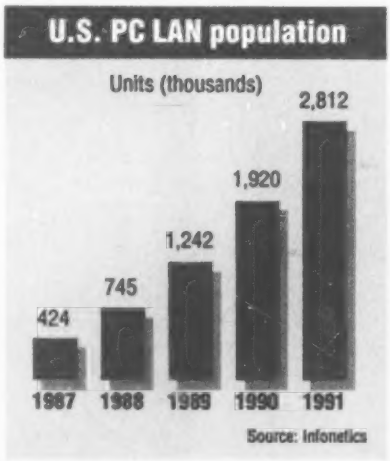
In unit terms, America's PC LAN market is expanding at a 54.5% compound annual growth rate, says Tom White, chairman of Infonetics, a Santa Clara-based market research and consulting firm. He predicts the 1987 installed base of 424,000 LANs will almost double this year, with 321,000 new LANs shipped in 1988. By 1991, White estimates, annual LAN shipments in the United States will reach 892,000.

Both hardware and software vendors are positioning themselves to reap the benefits of this explosive market. Backplane circuit boards and standalone adapter units are required to link personal computers, printers, disk drives and other equipment to the network media, and to connect LANs with one another and with wide-area networks. Meanwhile, software of all types is in demand, to establish basic communications protocols, to provide applications that run over the network and to oversee and manage the networks' overall operation.

This last function is addressed by network operating systems, and has become all but synonymous with Novell's NetWare product in the PC LAN environment. By mid-1988, Provo, Utah-based Novell had licensed approximately 220,000 copies of NetWare, representing 50% to 60% of the installed base of PC LANS. Not only is NetWare popular, it has managed to achieve "standard" status in some quarters, says analyst White. "Our research indicates that approximately 25% of the companies networking personal computers have standardized on NetWare," he says. "They simply won't install anything else."

Fly in ointment

The fly in NetWare's ointment is that it was created to run in a world largely populated by IBM and compatible personal computers running the MS/DOS (PC/DOS in IBM parlance) operating system. But in April 1987, IBM introduced its new generation of PCs, the Personal System/2s, running a new operating system, OS/2. OS/2-based computers have yet to make much of a dent in the marketplace, but such machines are expected to become the de facto standard in coming years.



Enter the Microsoft OS/2 LAN Manager. As its name implies, the product is designed to exploit the increased power and flexibility of 80286- and 386-based PCs running the multitasking OS/2 operating system. Still, the LAN Manager is not meant to be the last word in PC LAN operating systems in and of itself. Rather, it provides a range of basic networking functions and, most importantly, offers a series of application programming interfaces (APIs) upon which OEMs and software developers can build.

To attract OEMs to the LAN Manager fold, Microsoft and 3Com held a series of developers' conferences this spring and summer. More than 1,000 people attended, and as of late June, 3,000 to 4,000 LAN Manager development kits had been shipped, according to Eric Benhamon, vice president and general manager of 3Com's Software Products Division. By that point, Microsoft had signed up 35 OEMs committed to creating products based on the LAN Manager product.

The LAN Manager enthusiasts include big names like: Apollo Computer Inc.; AT&T's Information Systems operation; Compaq Computer Corp.; NCR Corp.; NEC Corp.; Nixdorf Computer AG; Tandem Computers Inc.; and Tandy Corp.'s Radio Shack division.

Thanks to its privileged position as a joint developer of the product, 3Com is likely to be the first OEM shipping a system based on the LAN Manager — the 3+Open network operating system, scheduled for release this month. The LAN Manager portion of 3+Open provides file-sharing and print-sharing functions

Mr. "I'm not scared." Mark Calkins, marketing vice president for Novell's Software Group, argues that growing support for LAN Manager from OEMs and software houses won't shift development activity away from NetWare

Ed Rosenberger

for the network, as well as a rich set of APIs, Benhamon explains. On top of that foundation, 3Com has added a number of features including electronic mail and internetworking services, support for Apple Computer Inc.'s Macintosh PCs, connections to mainframe computers, and network management services.

Microsoft is fully aware that the LAN Manager provides only a common foundation upon which to build, and the company is involved in other LAN-related development projects. One closely related to LAN Manager is the joint development with Hewlett-Packard Co. of the Microsoft LAN Manager/X (LM/X). This product will allow Unix System V-based computers to service requests from networked workstations running the OS/2 LAN Manager and other Microsoft system software. LM/X addresses the growing need of PC users to tap into the computational power and databases associated with computers running the Unix operating system.

Like 3Com, other OEMs will produce their own network systems based on LAN Manager, and these systems may differ greatly from 3Com's 3+Open in the range and sophistication of the features added to the Microsoft product. But applications software developed to run on any one of the LAN Manager networks should run equally well on all of them, says Benhamon, because they will share common communications protocols and applications interfaces.

Sophisticated products such as the 3+Open network operating system, not the foundation LAN Manager component, are what will compete directly with Novell's NetWare, explains William Becklean, vice president and telecommunications equipment analyst at the Boston offices of investment brokerage Kidder, Peabody & Co. "Although 3Com has done well in the hardware side of the business, it got a late start in the network operating system market," he says. "Building off of the OS/2 LAN Manager platform will give the company some potential to gain market share in that sector."

LAN Manager-based network op-

erating systems should compare favorably with NetWare because they permit the development of "distributed" applications software, claims Steve Kanzler, LAN Manager product manager at Microsoft. "The first generation of LANs permitted the sharing of expensive devices such as disk drives and laser printers," he says. "The second generation supported file sharing among networked computers, and NetWare represents the state-of-the-art of that generation.

Groupware

"The third generation, represented by LAN Manager, is the first to permit true distributed applications, or 'groupware,' over the network." Rather than the single-user applications that have been adapted for network use, distributed applications would make more efficient use of network resources and would permit groups of networked users to simultaneously work on common problems, Kanzler explains.

As a simple example of the advantages offered by distributed applications, 3Com's Benhamon notes that, when a PC user queries a centrally located database over most existing LANs, the entire database is shipped over the network to the user's workstation, which then runs the query application. A distributed database management application running on an LAN Manager network would, by contrast, permit the database server to run the query and just ship the results to the user's PC. This approach reduces network traffic and frees the PC workstation to perform other tasks.

Mark Calkins, vice president for marketing for the Novell Software Group, agrees that distributed applications are important, but he labels as "pure baloney" the claim that LAN Manager networks will be better able than NetWare to support such software. "There are no capabilities that LAN Manager networks can provide that we can't," he says. He also points out that distributed applications are nothing new, especially in the minicomputer networking world.

PC LANs have lagged, by contrast, because of the single-task nature of DOS-based computers. OS/2 machines, with their ability to run multiple programs at once, greatly improve the prospects for distributed networking applications over PC LANs, Calkins says, but he argues that LAN Manager networks will have no advantage over NetWare in this regard. Novell offers several products to support OS/2-based computers in the NetWare environment, and Calkins expresses no fear that the growing support for LAN Manager among OEMs and software houses will shift development activity away from the Novell system. Because of its broad market penetration, "No one developing applications will overlook NetWare," he believes.

Who's backing LAN manager

- Alcatel Information Systems
- Apollo Computer
- AT&T Information Systems
- Bull
- Compaq Computer
- NCR
- NEC
- Nixdorf
- Olivetti
- Siemens
- Tandem Computers
- Tandy
- Toshiba

Source: Microsoft Corp.

Walter Schramm, vice president for marketing at Gateway Communications Inc., an Irvine, California-based NetWare OEM, agrees. In addition, he points out, "It's too early to tell if LAN Manager will even hurt Netware. LAN Manager's success in the market will depend upon its performance and features relative to NetWare's, and [LAN Manager's] have yet to be proven."

Wild card

As a matter of fact, the view of some industry participants, LAN Manager could be a key factor in stimulating the nascent OS/2 marketplace. "LAN Manager is the first critical application out on OS/2," says Schramm at Gateway Communications. And Mike Barker, president of LAN vendor Micom-Interlan (a division of Micom Systems Inc. of Simi Valley, Calif.), believes the future availability of sophisticated applications developed for LAN Manager networks will boost demand for OS/2 machines. "OS/2 will ride the LAN Manager crest," he predicts.

One large wild card exists in this scenario, however: IBM. The computer giant will offer its own proprietary OS/2 networking product called LAN Server. Depending upon the information source, LAN Server is either virtually identical to the Microsoft OS/2 LAN Manager or is substantially different from it. For its part, IBM isn't talking — as usual. "We leave it up to the other vendors to announce compatibility with our products," says an IBM spokesman.

Should IBM's LAN Server differ appreciably from Microsoft's LAN Manager, the latter's attempts to generate broad-based OEM support could suffer greatly. However, major differences would also hurt IBM, analysts note, which can only benefit from the establishment of an OS/2 networking standard.

"IBM's primary goal continues to be the creation of increased cycle demand so that it can sell more computers," explains BRG's Myhre. "It can create that demand by providing compatibility between its LAN Server and the LAN Manager networks. This will encourage the development of higher level application programs, which will require the support of more powerful personal computers."

The same argument holds, however, for suggesting IBM's likely support of NetWare. "Applications running on NetWare will also stimulate demand for computers running OS/2," notes Novell's Calkins. He suggests that IBM has a multistandard networking strategy, and points out that Novell has worked closely with IBM on past projects. Analyst White agrees with the implication that IBM tacitly supports NetWare, saying, "There is no doubt that IBM considers Novell to be an ally."

As a result, most observers believe both NetWare and the LAN Manager networks will survive as standards in the LAN market. And, however the dust finally settles in this LAN turf battle, PC users can look forward to increased power and flexibility from their networked machines. "We need to be better able to take advantage of the intelligence of the network through distributed applications," concludes Microsoft's Kanzler, "so that the PC workstations don't have to do all the damn work alone."

DWIGHT DAVIS

OSI advocates interconnect to accelerate standards

Open System Interconnection enthusiasts join together to promote compatibility. Absent, however, are IBM and DEC

It seems like no cause is complete without a consortium and now, the ever-growing Open Systems Interconnection enthusiasts in the network management crowd can boast one as well. A group of eight computer and telecommunications companies — some of them rivals like AT&T and Northern Telecom Inc. — have banded together to smooth the way for development of network management tools that would adhere to OSI standards, and thus assure interconnectability of their products.

The group, called OSI/Network Management Forum, says that by agreeing on protocols and message sets from the myriad of options afforded by the seven-layer OSI, it will accelerate the development of compatible equipment by some two years. Industry observers are only cautiously optimistic, however, given the absence of certain network management movers and shakers like Digital Equipment Corp., IBM, Racal-Milgo, Codex and General Datacom.

They also point out that the formation of the consortium is not a move that will necessarily trigger breakneck growth in sales of OSI-based network management products. Rather, they see it as a logical step to combat industry giants IBM and DEC and their proprietary network and network management schemes.

Seven layers

Moreover, observers view it as a vehicle to whittle down to a workable size the massive standards encompassed under OSI, which according to proponent Jerry Foley, "could probably fill 10 file drawers." Foley is a senior engineer with Electronic Data Systems and chairman of the American National Standards Institute (ANSI) committee, responsible for defining OSI's upper three layers.

The OSI model defines seven layers of communications tasks that must be carried out to move data off one computer, through the network and onto another computer. At the top are the application, presentation and session layers. "They get traffic to the freeway on-ramp," according to the sponsors of the recent Enterprise Networking Event International in Baltimore, which was organized to promote OSI on the factory floor. The bottom layers — transport, network, data link and physical — "funnel traffic efficiently onto the freeway and off at the appropriate destination," explain the sponsors. At the receiving end, the same seven layers operate — in reverse order — to condition and format the data for storage or processing on another piece of equipment.

The forum introduced itself in midsummer, promising that member companies would demonstrate interoperable equipment in 18 months. Charter members, in addition to AT&T and Northern Telecom, are Amdahl Corp., British Telecommunications Plc, Hewlett-Packard Co., STC, Telecom Canada and Unisys Networks. Brian Hewat, a director of Telecom Canada, acknowledges that critical to the consortium's effectiveness will be its ability to "agree on a set of options within each of the seven layers of the OSI model."

A number of analysts are predicting the consortium will help forge alliances aimed at joint marketing of network and network management equipment, such as the Hewlett-Packard/Northern Telecom alliance — Corporate Networks Operation — formed earlier this year.

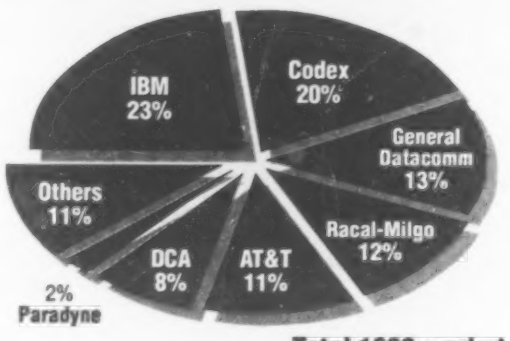
One company considering joining the group, Racal-Milgo, sees it as a vehicle "for making things happen" to bring uniformity to OSI and network management vendors, according to Bill Vasquez, product manager. Racal, he says, has been discussing possible strategic alliances with forum member AT&T, and with another prospective member, Digital Communications Associates Inc.

Still, there is the reality that some major players in network management have not carved their names into the OSI/NM Forum masthead. IBM, for one, has foregone membership, but says it will continue to review the possibility of joining. Its position reflects its stance in general. IBM has endorsed OSI, but has a much greater vested interest in its proprietary network management product, NetView, and its proprietary networking schemes — Systems Network Architecture and Systems Application Architecture. IBM will probably withhold from joining the group unless its OSI-based products begin to make major incursions on IBM market share in network management.

With or without the likes of IBM and Digital Equipment, the group must also figure out how to cooperate while many of them battle each other in the market. "It's sort of like an oil cartel, trying to address the pricing policy while competing," says Jeffrey Kaplan, an analyst with the Ledgeway Group in Boston. "Forum members are trying to develop common standards — while competing."

MARK HALPER

Network management market leaders



Total 1988 market
$3.3 billion

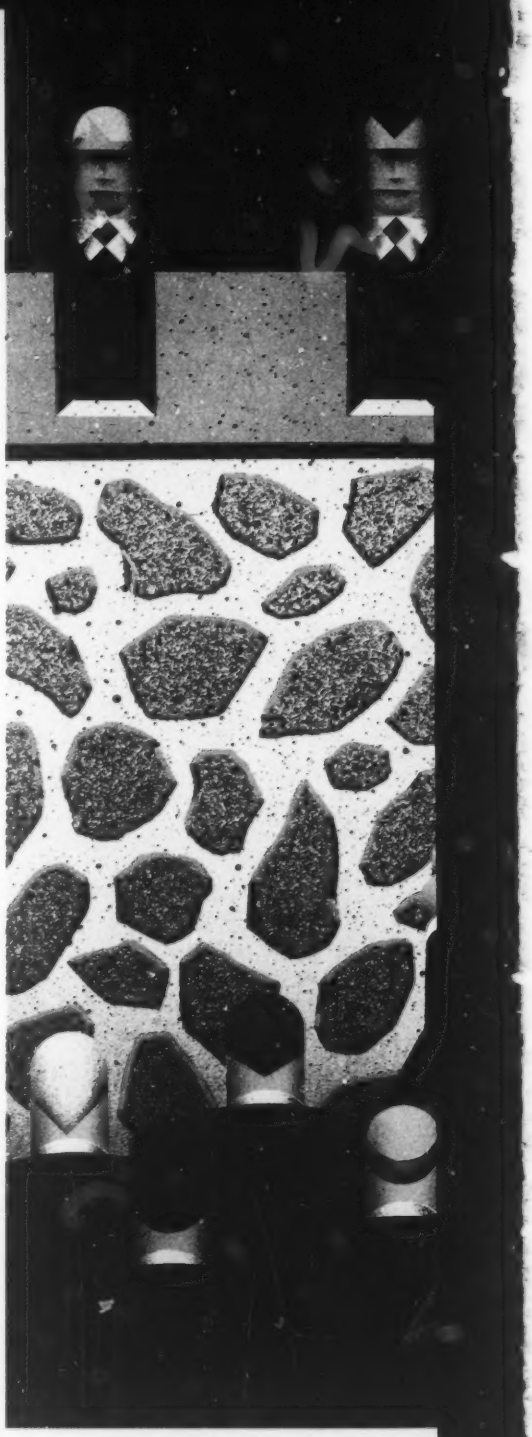
Source: International Technology Group

EC firms have embarked on international crusades to expand their influence. These campaigns could leave unprepared U.S. firms outside the kingdom gates.

Inside the fortress

Europe after 1992

BY SHERRY BUCHANAN



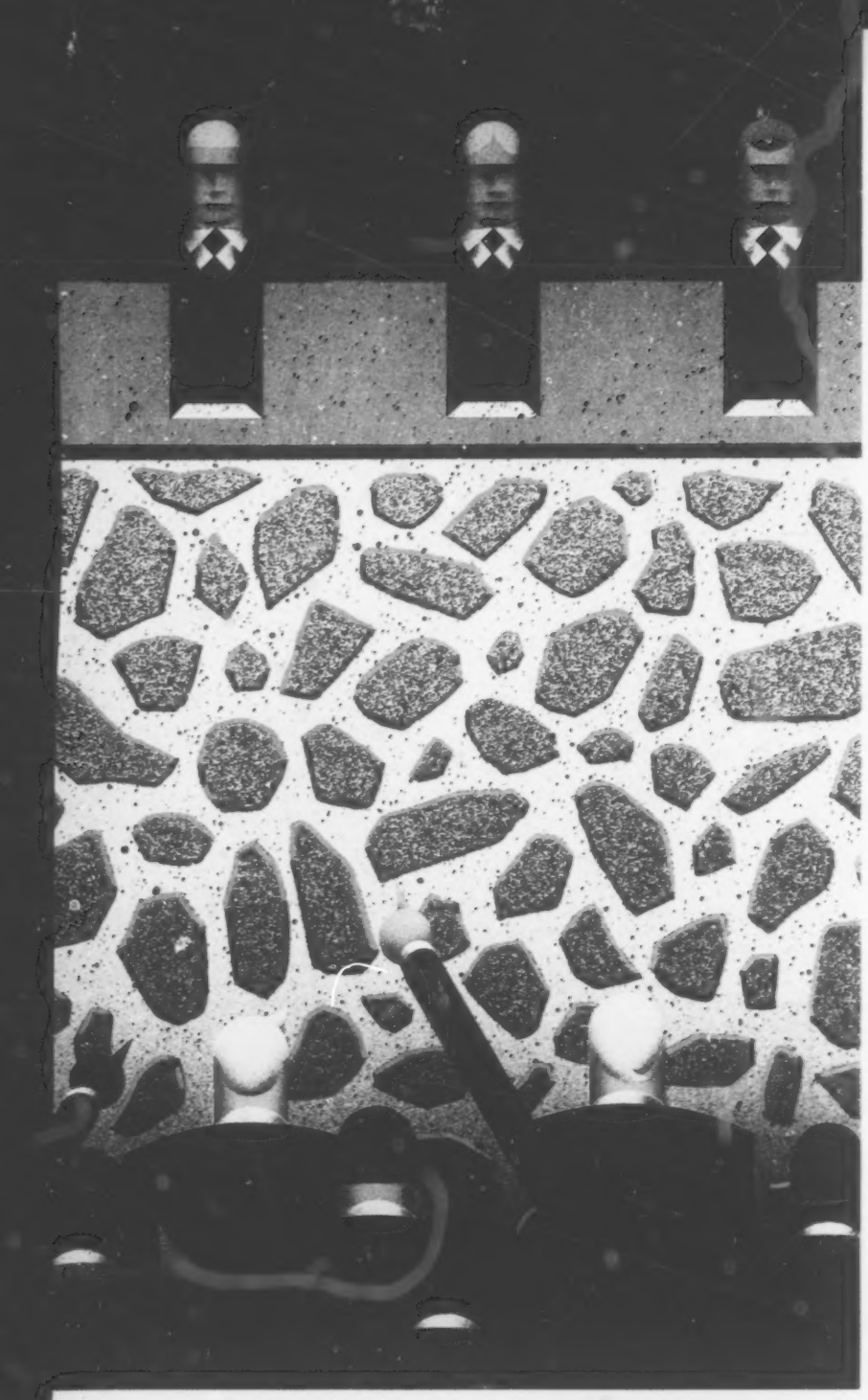
Europe's top electronics companies are scrambling to build global empires. They realize that they must expand volume to achieve the economies of scale necessary to finance high-technology growth. With some markets shrinking and competition from the United States and Japan increasing, those businesses that don't look beyond their borders will wind up as also-rans. "The globalization of the technologies and markets which fall within our sphere of operations calls for a worldwide approach to product policy," says C.J. van der Klugt, president of N.V. Philips GL of the Netherlands.

European firms will get a major boost in their international expansion plans in 1992, when the financial and trade barriers between countries are torn down. This will give EEC firms immediate access to a market with more people than the U.S. and about the same gross national product. With the so-called "United States of Europe" less than four years away, many companies have begun to stake out their claims in their expanding home territory.

Britain's The Plessey Company Plc, for example, has formed an International Development Group to, in the words of chairman Sir John Clark, "address urgently and vigorously the opportunities presented by this huge new market" and, like others, expand its ties with neighboring companies; in Plessey's case, Elettronica of Italy. "The year 1992 will be a watershed for industry throughout Europe," says Clark. "It will have profound effects on industrial companies."

But many Europeans worry that eliminating internal borders to allow free trade within the Common Market won't be enough. As a result, leading electronics companies may want to build higher walls to keep out non-European products. This worries Peter McPherson, deputy secretary of the U.S. Treasury Department, who is concerned that "an intensification of protectionism" could follow the restructuring.

At least some European firms are expected to lobby for tariffs, quotas and other trade restrictions to keep others out of the post-1992 Euromarket. Philips, for example, wants the EC action to block Japan from flooding the market with color televisions. Philips has scars from previous wars with the Japanese, notably in video cassette recorders. Philips virtually invented VCRs, but the Japanese came out with a competing standard and Philips had to toe their line. It's not all bad news for outsiders, though. Foreign companies located within the EC borders and those with European partners stand to benefit from the change to a Euromarket. (See related story in this issue on how



to do business in post-1992 Europe.)

In the accompanying tables, ELECTRONIC BUSINESS has ranked the top European electronics companies. This exclusive report is based on careful analysis of the financial statements of the largest companies doing business in Europe. Leading the list are Philips, IBM and Siemens. IBM Europe is consolidating its position as a strong, local company. Philips and Siemens are dramatically restructuring operations to survive in the changing marketplace.

Europe is not without its success stories. Still, much remains to be done if electronics companies want to make the most of the enlarged internal market. A controversial McKinsey & Co. report, published in July, compares British electronics companies with other European, U.S. and Japanese firms, and goes as far as saying that British electronics companies will not "survive" against Japanese, U.S. and some Western European competitors unless they radically change their current strategies.

The report criticizes Britain's electronics sector for relying too much on slow-growing defense and telecommunications business for revenue and also for not having expanded enough either in Europe or other international markets. "British electronics companies must invest to produce the critical mass necessary to be viable competitors in their chosen global markets," says Adair Turner, coauthor of the McKinsey report titled: "Performance and Competitive Success: Strengthening Competitiveness in the U.K. Electronics Industry."

The probability of a significant improvement in Britain's competitive performance — or even the survival of British electronics — looks dim unless major changes are made. The report, for instance, shows that, as a whole, British electronics companies have lost market share even in their home market. In 1976, they accounted for almost half of Britain's sales. By 1986, however, this figure had declined to less than a third.

International rivals

In addition to losing ground in their own home market, they haven't expanded internationally as much as their foreign rivals. As a result, in McKinsey's view, U.S., Japanese and some Western European companies — such as Philips, Thomson-CSF, L.M. Ericsson and Ing. C. Olivetti & Co. — are better prepared to take advantage of the new opportunities of the soon-to-be-borderless Europe. These companies already are present in many of the individual EC markets and have, or are building, management structures suited to running global organizations.

McKinsey argues that some big U.S., Japanese and other Western European companies already generate a larger proportion of their home sales outside their home markets and are truly global companies. Meanwhile, British electronics companies, other than perhaps Racal Electronics and British Aerospace Plc, have not taken a long-term approach and built up their international organizations.

Holland's Philips, for example, sells 93.3% abroad; America's Rank Xerox sells 84.3% outside its home market; Sweden's Ericsson, 78%; Japan's Sony Corp., 70.5%; Italy's Olivetti, 65.7%; and France's Thomson, 60%. Britain's two exceptions, British

Jose Cruz

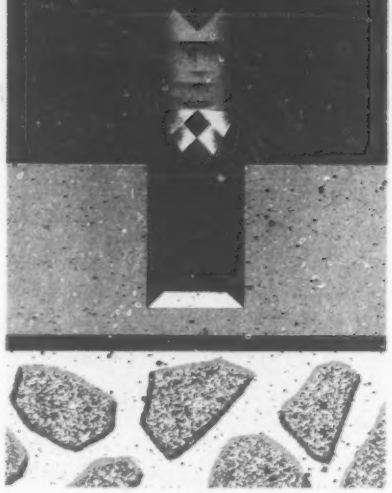
Aerospace and Racal, sell 66% and 60%, respectively, outside their home markets. Germany's giant Siemens AG, meanwhile, could take a lesson from others: It sells only 50% of its product in foreign markets. (Siemens is dramatically changing its strategy, see accompanying story.)

Doomsday scenario

London analysts do not all concur with McKinsey's doomsday scenario. In defense of British electronics companies' slow expansion into other EC countries, analysts point out it is a difficult task to find partners on the continent and that it takes time. "Europeans on the continent are very difficult to acquire," for example, says Miles Saltiel, electronics analyst with Hoare Govett, a London brokerage house. "You need long-term relationships and a lot of them have restricted share practices. A British company can't just go in there and do a hostile takeover."

At least one British firm targeted in the report's criticism, is currently reorganizing. Britain's General Electric Co. (GEC, no relation to the U.S. General Electric), which has operated with 120 independent subsidiaries, is centralizing control to ensure the convergence of new technologies. "So much of McKinsey's report seems to be aimed at GEC without specifically saying so," says Philip Hughes, chairman of Logica Plc, the British software house. "And the approach of having very decentralized development activities does make it very difficult to launch strategic initiatives."

Overpowering tough competitors abroad is proving a difficult task for some of the big European electronics companies —even those that are ahead of the game, relative to the British. Price pressures in the consumer electronics sector and competition from low-cost producers such as the Koreans have forced the major European companies to merge or be acquired. Last year, England's Plessey and GEC combined their strengths in telecommunications; Plessey expanded its stake in Elettronica to 49%; and Sweden's Asea AB and West Germany's BBC Brown Boveri merged the worldwide electrical engineering activity. It is essential "to utilize the global economies of scale" and focus on "growth ambitions in Europe and transoceanic countries," according to Percy



"The restructuring of the European market could possibly lead to an intensification of protectionism"

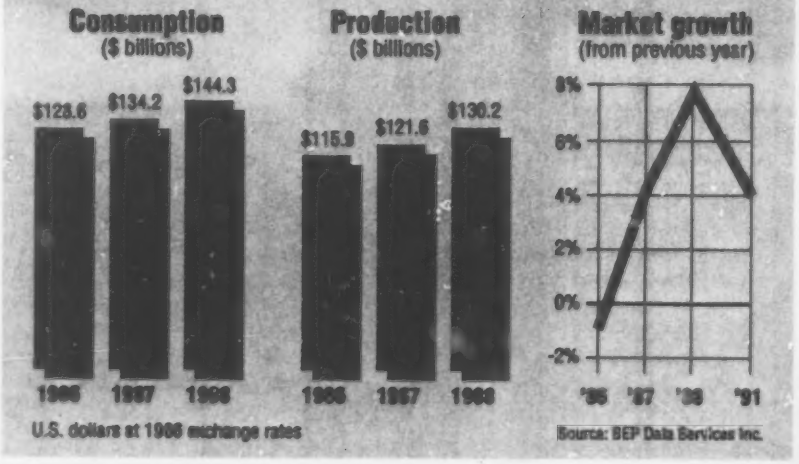
Barnevik, Asea president and CEO.

Meanwhile, Philips, which employs 340,000 worldwide, is facing the difficult task of going through a massive internal reorganization to cut costs by 800 million guilders (or $374 million — in late August, 2.14 guilders = $1) this year. In Europe, Philips says it will cut middle management by 20,000 people. During the next five to 10 years, it will close 70 European plants. Philips has already laid off 6,000 European employees and expects between 4,000 and 14,000 more job losses. Like GEC, Philips in the past relied on fiercely independent national subsidiaries. As part of the move to tighten control over national organizations, Philips has just named Geerit Jeelof, formerly vice chairman of the board of management, to head its U.S. operation.

"Philips is a microcosm of the whole industry and a very good indicator of what's going on in other places," says Angela Dean, analyst at Robert Fleming Securities Ltd., a London brokerage house. For example, at the end of July, Philips' second quarter net profit plunged 44%, an unexpectedly poor showing which sent stock down. Many analysts had expected Philips' earnings to be about equal to last year's, at 818 million guilders, or $382 million. Philips is Western Europe's biggest maker of semiconductors and consumer electronics products. Turnover has fallen steadily since 1985 and profit margins in the 1980s are not what they were in the 1960s.

"Our major task is to find an answer to what is the most pressing problem in consumer electronics, and that is constant price erosion," says Jan Timmer, Philips board member responsible for consumer electronics. "We have two to three years to know whether Philips will be able to make it in consumer electronics." Philips blames Japanese and Korean dumping. But, contends Pat Meagher-Davis, European electronics analyst with James Capel and Company, in London: "Antidumping measures

European electronics industry



U.S. dollars at 1988 exchange rates

Source: BEP Data Services Inc.

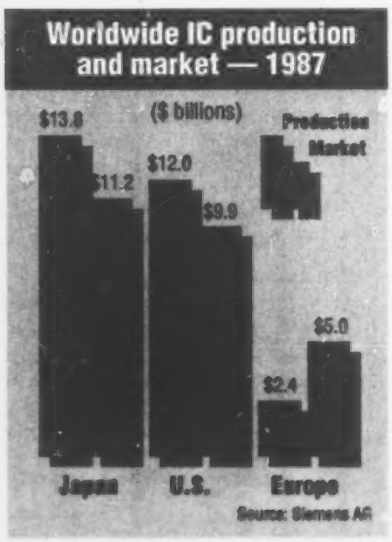
wouldn't solve the problem, it would only buy them time."

Philips, meanwhile, is rationalizing production, closing European plants and transferring manufacturing to the Far East. Executives say this shift will continue. Philips says survival depends on taking advantage of economies of scale and becoming a low-cost producer. The Dutch giant already has 27,000 employees and 25 plants in Japan, Hong Kong and other Asian countries and plans to shift more production there, as well as to Mexico. In Asia, Philips already manufactures black-and-white televisions, radios and video cassette recorders, which it sells worldwide. Philips also has plans to expand product development and engineering activities in the Far East.

Computer firms hold out

Despite this flurry of activity around the world, the majority of European computer makers are staying closer to home for the time being, although some of the larger players like Siemens are likely to increase their size and expand in European markets and, eventually, the United States. Others, like West Germany's Nixdorf Computer AG are, however, eyeing the world markets — with some success.

"It is going to get very hot in the computer sector, where not much restructuring has happened yet, and life is quite difficult," says Dean of Robert Fleming. "Too many companies are competing in a market that



The post-1992 Euromarket will have more people than the U.S. and about the same gross national product

is dominated by United States suppliers. [illegible] computer companies remain strong market leaders in the European market, according to Dataquest. IBM has 56% of the European market in corporate resource computers (computers which cost more than $1 million). Digital Equipment Corp. is the leader in business unit computers with 20% of the European market (computers which cost between $75,000 and $250,000).

Eventually, industry observers say, European computer companies will reorganize through mergers and acquisitions. Margins are being squeezed, market growth has slowed and most European companies are small relative to the giant United States firms. "We will see a lot of M&A activity — especially between hardware and software companies," says Meagher-Davis. "And a lot of those companies are cheap."

According to Meagher-Davis, European companies should be well placed to take advantage of what she calls the " 'microcomputer application.' You can't sell people just a box anymore, you have to sell them the total solution," she says. "Unlike the U.S. companies, European companies — Nixdorf is a prime example — have grown up that way." Some consolidation has already taken place between suppliers of hardware.

In January of last year, Siemens and BASF combined their IBM-compatible mainframe businesses to create Comparex, with sales of $500 million. And in March 1987, France's Groupe Bull, the United States' Honeywell Inc. and Japan's NEC Corp. created an organization with sales worth $2.1 billion. Britain's STC, which bought ICL, the British computer company, is currently looking for software houses to buy in West Germany.

As European companies restructure to secure their soon-to-be-expanded European home market, analysts also predict they will become more active in the U.S. market. In July, Siemens, the German electronics concern, signed an agreement to acquire a majority interest in Allied-Signal Inc.'s Bendix automotive electronics group for some $250 million. In the last few months, Siemens has set up ventures with Intel Corp. in microcomputers; Advanced Micro Devices Inc. in telecommunications and semiconductors; and Westinghouse Electric Corp. in factory automation and industrial controls.

According to analysts, there have been few moves by either U.S. or Japanese companies to acquire European firms. The United States' General Electric Co. did, however, take on Thomson-CGR, Thomson's medical systems business, as part of a deal whereby Thomson acquired GE's consumer electronics business. "If you look at computers and consumer electronics, the U.S. and Japanese companies are already significant competitors. The fight will be in public telecommunications. I don't think the European companies are badly placed," says Dean. "It suddenly may look a lot easier to the U.S. and Japanese companies to come into a big market, the European internal market. But there are opportunities on both sides."

The success story on everyone's mind is Ericsson. "For really good companies, the liberalization of telecommunications buying practices and the impending advent of 1992 will be a challenge," says Dean. "Just look what Ericsson did. It realized it couldn't survive in just Sweden, so it took advantage of the opening of the world telecommunications markets." Ericsson, which was an early leader in public switching systems, has captured 40% of the world cellular radio market. Others dream of similar success stories. □

Top European electronics companies

Rank	Company	Electronics sales ($ millions)	Electronics sales as a percentage of total sales	Total consolidated sales ($ millions)	Profit before tax as a percentage of sales	Profit after tax as a percentage of sales	Sales per employee	Profit before tax per employee
1	**Philips**	$18,825	72%	$25,968	1.9%	1.5%	$77,125	$1,488
2	**IBM**	18,332	34%	54,217	15.9%	9.7%	139,251	22,111
3	**Siemens**	15,098	55%	27,503	5.1%	2.5%	76,611	3,870
4	**CGE**	12,770	60%	21,208	3.9%	2.5%	96,620	3,808
5	**Thomson-CSF**	5,970	100%	5,970	10.4%	7.3%	NA	NA
6	**GEC**	5,756	61%	9,457	12.7%	8.1%	60,136	7,667
7	**Olivetti**	5,121	90%	5,688	7.3%	5.5%	NA	NA
8	**Ericsson**	4,238	83%	5,102	3.4%	2.3%	71,973	2,461
9	**Robert Bosch**	3,954	28%	14,092	6.9%	3.3%	87,340	5,987
10	**Xerox**	3,325	32%	10,320	8.1%	5.6%	104,209	8,482
11	**DEC**	3,253	35%	9,389	18.0%	12.1%	84,972	15,284
12	**STC**	3,147	93%	3,388	9.1%	6.0%	97,054	8,829
13	**STET**	3,113	26%	11,972	9.3%	7.2%	96,315	8,947
14	**Nixdorf**	2,817	100%	2,817	6.5%	5.2%	95,687	6,238
15	**British Telecom**	2,805	16%	17,346	22.5%	14.3%	73,125	16,456
16	**Hewlett-Packard**	2,667	33%	8,090	11.9%	8.0%	98,659	11,732
17	**Unisys**	2,400	25%	9,713	9.8%	6.0%	105,004	10,243
18	**AEG**	2,333	36%	6,478	0.7%	0.0%	80,972	576
19	**Sony**	2,290	22%	10,347	5.1%	2.6%	171,025	8,783
20	**Matsushita**	2,233	6%	34,839	8.9%	3.4%	259,632	23,232
21	**Plessey**	2,216	100%	2,216	13.2%	9.1%	73,512	9,725
22	**Racal**	2,113	91%	2,328	10.1%	6.6%	72,970	7,370
23	**Canon**	2,058	30%	6,753	4.1%	1.4%	179,984	7,415
24	**NCR**	1,797	32%	5,641	13.5%	7.4%	90,979	12,297
25	**Nokia**	1,499	47%	3,174	9.0%	6.0%	NA	NA
26	**Grundig**	1,524	100%	1,524	4.9%	3.5%	78,241	3,844
27	**Thorn EMI**	1,352	26%	5,201	7.4%	4.8%	81,268	5,995
28	**Schlumberger**	1,300	30%	4,402	14.1%	11.4%	88,040	12,371
29	**Motorola**	1,200	18%	6,707	6.2%	4.6%	68,649	4,258
30	**Ferranti**	1,121	80%	1,400	8.3%	5.6%	56,414	4,666
31	**Control Data**	1,119	33%	3,367	1.7%	0.7%	97,580	1,664
32	**Bayer**	1,111	5%	20,635	8.3%	4.2%	125,517	10,361
33	**Mannesmann**	1,083	12%	9,253	1.7%	0.8%	81,685	1,365
34	**Honeywell**	1,005	15%	6,679	6.2%	3.8%	84,676	5,222
35	**Fiat Group**	928	3%	29,384	NA	NA	107,047	NA

NA = Not available

Electronics sales: Represents ELECTRONIC BUSINESS' estimate of the revenue earned by each company from the sale of electronics products.

The figure shown is based on the latest available completed fiscal year, thus a variety of accounting periods are represented.

Similarly, the electronics sales and other financial information have been converted to dollars using an exchange rate that consists of the average rate during each company's fiscal year.

For European companies, the figure shown is their worldwide sales of electronics products, including those manufactured and sold outside Europe; for non-European companies the figure estimates their electronics sales in Western Europe only.

Electronics as a percentage of total sales: Indicates the proportion of electronics products within the total consolidated sales of all the products of the company. For firms not European owned, the percentage relates to their electronics sales in Western Europe as a percentage of total consolidated worldwide sales.

Profit after tax per employee	Fixed assets per employee	Investments as a percentage of sales	Return on gross capital employed	R&D as a percentage of sales	Capital expenditures as a percentage of sales	Current ratio	Fiscal year ended	Country of origin
$1,182	$27,048	16.0%	3.2%	8.3%	7.7%	1.49	12/87	Netherlands
13,505	58,873	18.0%	17.1%	10.0%	7.9%	2.32	12/87	U.S.
1,900	19,989	21.3%	5.9%	12.1%	9.2%	3.73	9/87	West Germany
2,367	14,624	11.7%	7.5%	7.8%	3.9%	1.28	12/87	France
NA	NA	NA	NA	NA	NA	NA	12/87	France
4,882	8,930	17.1%	20.8%	12.1%	5.0%	2.11	3/88	Britain
NA	NA	NA	NA	0.7%	NA	NA	12/87	Italy
1,633	15,057	14.8%	5.2%	9.9%	4.9%	2.02	12/87	Sweden
2,839	13,905	13.6%	18.0%	5.6%	7.9%	2.08	12/87	West Germany
5,836	25,416	16.1%	11.0%	7.0%	9.1%	1.56	12/87	U.S.
10,293	19,252	18.7%	26.0%	10.8%	8.0%	3.40	6/87	U.S.
5,809	15,582	14.2%	25.0%	8.5%	5.7%	1.70	12/87	Britain
6,931	191,272	NA	NA	NA	35.8%	NA	12/87	Italy
4,985	29,278	23.4%	9.7%	9.4%	14.0%	2.36	12/87	West Germany
10,475	87,234	25.1%	19.4%	1.9%	23.2%	0.90	3/88	Britain
7,854	28,390	17.4%	18.9%	11.1%	6.3%	2.01	10/87	U.S.
6,249	22,929	13.6%	24.3%	6.1%	7.4%	1.33	12/87	U.S.
0	12,354	13.3%	1.3%	8.0%	5.4%	4.38	12/87	West Germany
4,390	50,942	18.2%	10.7%	8.9%	9.3%	1.14	3/88	Japan
8,773	29,301	9.3%	12.9%	5.6%	3.6%	2.15	3/88	Japan
6,708	13,528	12.6%	21.4%	7.2%	5.3%	1.50	3/88	Britain
4,781	20,367	9.8%	19.3%	NA	9.8%	1.53	3/88	Britain
2,441	43,606	12.3%	6.6%	5.8%	6.5%	1.73	12/87	Japan
6,763	17,068	13.2%	33.7%	6.3%	6.9%	1.72	12/87	U.S.
NA	NA	NA	NA	NA	NA	NA	12/87	Finland
2,751	10,686	9.9%	19.9%	3.4%	6.5%	1.25	3/87	West Germany
3,893	24,828	14.2%	21.1%	1.1%	13.1%	1.09	3/88	Britain
10,051	33,407	14.3%	15.1%	8.0%	6.3%	1.66	12/87	Netherlands Antilles
3,153	23,838	17.6%	12.4%	7.8%	9.8%	1.62	12/87	U.S.
3,136	17,094	10.1%	15.6%	4.9%	5.2%	1.31	3/88	Britain
722	17,675	16.9%	4.3%	11.6%	5.3%	1.63	12/87	U.S.
5,218	34,962	13.1%	24.1%	6.2%	6.9%	1.26	12/87	West Germany
656	19,785	6.2%	4.0%	2.2%	4.0%	1.42	12/87	West Germany
3,216	17,454	9.0%	18.0%	4.3%	4.7%	1.24	12/87	U.S.
NA	NA	NA	11.9%	3.5%	8.4%	NA	12/87	Italy

Fixed assets per employee: Shows the accumulated value (less depreciation) of land, buildings, plant, machinery, furniture and fittings (including rental equipment) that the company has invested per employee.

Investments as a percentage of sales: Adds together capital expenditures and research and development as a proportion of total consolidated sales.

Return on gross capital employed: Shows profit before taxes as a proportion of net working capital plus fixed assets and investment (for example, equity holdings and other assets, not capital expenditures).

Capital expenditures as a percentage of sales: Shows the amount of new investment in fixed assets during the year as a proportion of total consolidated sales.

Current ratio: Shows current assets as a proportion of current liabilities, giving a rough indication of the liquidity of the company.

Country or origin: Indicates the country in which the company is ultimately registered.

Source: ELECTRONIC BUSINESS

Power pay: How the big guys made even more money

The 100 highest-paid electronics executives had to put up with a 23% raise last year. Their average take-home? Just $780,000

BY TONY GREENE

Most of us fret about how we're going to make ends meet on our inflation-pacing salary increments. But not the top executives in the U.S. electronics industry. The 100 highest-paid are plagued instead by the nightmare of how to spend their 23% raise.

According to a new survey by ELECTRONIC BUSINESS, the average paycheck for the top-paid 100 electronics executives rose $149,094 in 1987, or 23.5% over the past year, making for an average *weekly* compensation of $15,100.

And ELECTRONIC BUSINESS' "million-dollar club" boosted its membership dramatically as the ranks of those bringing home seven-figure compensation rose from six to 17. Disk-drive maker Seagate Technology Inc. claimed the honor of having the most new members initiated into the club, bringing three new names to the list.

The big winners were computer company executives, with over 50% of this year's highest-paid 100 coming from computer, peripherals or software companies. Also, with the exception of Xerox Corp. and Advanced Micro Devices Inc., all the members of the million-dollar club came from this same group.

One of the major reasons for the boost to top executive compensation is the increased profitability of the electronics industry in 1987. The recent ELECTRONIC BUSINESS 200 survey found that sales for the top 200 U.S. electronics companies were up 7.4%, while profitability climbed 53.6% [ELECTRONIC BUSINESS July 15, 1988 p26]. This translates into dollar signs for executives whose salaries and bonuses are normally tied to the performance of the company.

While cash is still king in the world of executive compensation, there are other factors that top staffers are beginning to look for. Research by ELECTRONIC BUSINESS reveals several distinct trends:

- Contracts, which have not been prevalent until recently, are becoming more popular. This is believed to be mainly in response to executives' need for a feeling of security in today's volatile mergers-and-acquisitions world.
- As the industry matures, companies are looking for older, more seasoned executives to head companies. But "mature" is a relative term; and senior executives in the electronics industry still tend to be younger than execs in other industries.

The bottom line for the electronics industry's highest-paid execs: Cash is still king

- Perquisites such as company houses and cars, while still nice, are not the incentive they used to be under the new tax laws. Executives and their recruiters are holding their breath to see what the coming year will bring in the area of taxes.
- Executive recruiters see a shortage of qualified upper level executives in the future of the electronics industry — a shortage that will make compensation a critical factor as companies strive to get and keep top level people.

Seagate is one company that should not have to worry about keeping its execs. The disk-drive maker boasts three chiefs in the ELECTRONIC BUSINESS power-pay club — David T. Mitchell, president and COO; Douglas K. Mahon, senior vice president and chief technical officer; and Alan F. Shugart, chairman of the board and CEO. And it places two other executives in the top 100, putting all five of their top-paid executives on the rolls.

Seagate's top trio experienced an average increase of 209.2% — compensation that came as a direct response to the company's performance in 1986 and 1987. Seagate declined to comment on whether salaries this year would show a corresponding decrease as the company reported a fall in net income of 56% in the fourth quarter of fiscal 1988, ended June 30.

In addition to Seagate, Apple Computer Inc., Compaq Computer Corp. and Unisys Corp. all put five executives in the top 100. John Sculley, Apple's president and CEO, leads this year's list with a modest increase of 26.1% to $2,140,000. The No. 2 on ELECTRONIC BUSINESS' top-pay list, W. Michael Blumenthal, chairman and CEO of Unisys Corp., is the only person in the top five to show a decrease: 28.8% down from 1986 to give him cash compensation of $1,549,440.

Honeywell Inc.'s top paid executives — Edson W. Spenser, chairman and CEO; and James J. Renier, president and COO — provide a good example of how executive compensation can be tied to profitability. Both men experienced reductions in their cash compensation in 1986 [ELECTRONIC BUSINESS Oct. 15, 1987 p52] when Honywell reported a loss of $389 million. In fact, in 1987, when the company showed net income of $254 million, Spenser and Renier had an average increase of 88.5%. A spokesperson for Honeywell says that executive compensation is tied to three factors: the company's earn-

The men with the megabucks: Apple Computer chairman John Sculley, $2,140,000; Unisys chairman Michael Blumenthal, $1,549,440; Computer Associates CEO Charles Wang, $1,431,000; Compaq Computer president Joseph "Rod" Canion, $1,375,000; and Seagate Technology president David "Tom" Mitchell, $1,354,975

Dorothy Ahle

ings, return on investment and return on equity.

Executive salaries have risen strongly throughout the electronics industry. A recent survey by the American Electronics Association shows that last year, executive salaries posted their largest average increase — 7.5% — since 1984. This is up more than 2% from the previous year. This is still not as high, though, as the average increase for top executives in all industries. Jill Kanin-Lovers, an associate at Towers, Perrin, Forster and Crosby, a New York City-based consulting firm that specializes in executive compensation, says that according to their survey, senior benchmark salaries rose an average of 12% in 1988.

Sign here, please

Although salaries are going up and business is good, many executives are edgy about their security and are asking for contracts. Alan Glou, president of Needham, Massachusetts-based Glou International Inc., an executive search firm that specializes in the electronics industry, says, "They're looking for security with companies that have the ability to be acquired." What most of the contracts amount to is a guarantee of severance pay — a buy-out clause — if the company is acquired. Chris Blake, president of San Jose executive search firm Robert S. Blake Associates Inc., says, "There is no security in the electronics industry —only opportunity."

Another factor that is going to be figuring into executive compensation is the law of supply and demand. "There is a shortage of seasoned, qualified people at the upper executive level," says James W. Furlong, president of Van Nuys, California-based executive search firm Furlong-Gates. As the industry matures, there is a greater need for experienced top level management that will give executives leverage to demand greater cash compensation in the future.

One of the problems is the general feeling — Sculley's crossover from PepsiCo Inc. to Apple notwithstanding — that executives from other industries cannot run electronics concerns. Gene Spence, a partner at the executive search firm Heidrick and Struggles Inc., which placed Sculley at Apple, says, "Sculley is the exception, not the norm."

The bottom line is that cash is still king. Perquisites such as company houses and cars are not as popular as they once were because thay are currently taxed like cash, so senior staffers feel they may as well settle for cash in the first place. But, while cash may be king, stock options are not dead. They are still a major part of any upper-level compensation package. The increase in cash is in addition to, not instead of, stock options. This is even true of executives going to start-ups and venture capital-backed firms. "Gone are the days when executives will take a hit to go to a venture-funded company," says Spence. □

Top paid executives

Rank	Executive/age	1987 salary	Percentage change from previous year	Company	Position
1	John Sculley/48	$2,140,000	26.1%	Apple Computer	Chairman, president, CEO
2	W. Michael Blumenthal/62	1,549,440	-28.8%	Unisys	Chairman, CEO
3	Charles B. Wang/43	1,431,000	NA	Computer Associates	CEO, chairman
4	Joseph R. Canion/42	1,375,000	150.0%	Compaq Computer	President, CEO, director
5	David T. Mitchell/45	1,354,975	193.2%	Seagate Technology	President, COO
6	Douglas K. Mahon	1,274,120	210.4%	Seagate Technology	Senior VP, chief technical officer
7	Alan F. Shugart/56	1,263,951	223.9%	Seagate Technology	Chairman, CEO
8	Paul G. Stern/48[1]	1,195,920	43.4%	Unisys	President
9	John A. Young/55	1,193,300	29.8%	Hewlett-Packard	President, CEO, chairman
10	Anthony W. Wang/45	1,188,000	NA	Computer Associates	President, COO, director
11	David T. Kearns/57	1,165,465	33.2%	Xerox	Chairman, CEO
12	W.J. Sanders III/51	1,057,080	121.6%	Advanced Micro Devices	Chairman, CEO
13	Joseph J. Kroger	1,029,337	NA	Unisys	Vice chairman
14	Fred W. O'Green/66	1,022,510	NA	Litton Industries	Chairman, director
15	Edson W. Spenser/61	1,014,185	80.5%	Honeywell	Chairman, director
16	Charles E. Exley Jr./58	1,001,200	6.7%	NCR	Chairman, CEO
17	Paul C. Ely Jr./56	1,000,000	-15.9%	Convergent	Chairman
18	Jim P. Manzi/36	940,872	18.4%	Lotus	President, chairman, director
19	John V. Roach/48	916,240	50.5%	Tandy	Chairman, CEO, president
20	Kenneth H. Olsen/61	905,706	20.0%	Digital Equipment	President, CEO
21	Thomas P. Howes[2]	901,000	NA	Esterline	President
22	John C. Lewis/52	898,013	8.1%	Amdahl	Chairman, CEO
23	Robert M. Price/57	885,858	7.0%	Control Data	Chairman, president, CEO
24	Melvin Howard/53	875,952	24.5%	Xerox	Vice chairman, subsidiary officer
25	Edward M. Esber, Jr./35	874,086	-7.3%	Ashton Tate	Chairman, CEO
26	James J. Renier/58	861,256	96.5%	Honeywell	President, COO, CEO, director
27	John F. Akers/53	840,896	18.1%	IBM	Chairman
28	David R. Tacke/65	837,319	22.2%	E-Systems	Chairman, CEO
29	Delbert W. Yocam	832,000	69.2%	Apple Computer	Executive VP, COO
30	John F. Cunningham/45	831,664	NA	Computer Consoles	Chairman, president, CEO
31	Jean-Louis Gassee	831,000	148.5%	Apple Computer	VP product development
32	Eckhard Pfeiffer/45	827,965	176.0%	Compaq Computer	Senior VP international
33	Stephen L. Lane/51	827,500	NA	Emerson Radio	President
34	William W. Lane/53	827,500	NA	Emerson Radio	Chairman
35	John T. Hartley/57	819,578	30.0%	Harris	President, CEO
36	Anthony R. Hamiliton/63	814,668	14.3%	Avnet	Chairman, CEO
37	Leon Machiz/63	814,668	14.3%	Avnet	Vice chairman, COO, president
38	William F. Glavin/56	800,014	37.6%	Xerox	Vice chairman
39	Frank G. Hickey/60	797,767	79.8%	General Instrument	Chairman, CEO
40	James A. Unruh/46[1]	795,961	73.3%	Unisys	Executive VP
41	George B. Harvey/56	794,093	-28.0%	Pitney Bowes	Chairman, president, CEO
42	Orion L. Hoch/58	782,621	NA	Litton Industries	President, CEO, director
43	Donald L. Waite	762,303	191.1%	Seagate Technology	Senior VP, CFO
44	William F. Schmied/59	756,933	28.3%	Singer	President, COO
45	Dean O. Morton/55	750,121	29.6%	Hewlett-Packard	Executive VP, COO, director
46	William J. Weisz/60	746,170	27.1%	Motorola	Vice chairman
47	Joe M. Henson/54	737,857	7.9%	Prime Computer	President, CEO, director
48	Lawrence J. Ellison/43	711,875	NA	Oracle	President
49	Paul A. Allaire/49	709,119	49.3%	Xerox	President
50	Michael H. Spindler	709,000	47.6%	Apple Computer	Senior VP, int'l sales & marketing

[1] resigned Dec. 31, 1987
[2] resigned
NA = Not available

(Continued)

Top paid executives

Rank	Executive/age	1987 salary	Percentage change from previous year	Company	Position
51	**Norbert R. Berg/56**	$707,940	5.2%	Control Data	Deputy chairman
52	**Andrew S. Grove/51**	697,011	92.5%	Intel	President, COO
53	**Bertil D. Nordin/53**[3]	686,077	85.5%	Digital Communications	President, chairman, CEO
54	**Sidney Topol/62**	685,995	76.6%	Scientific-Atlanta	Chairman
55	**C. Peter McColough/65**	685,310	23.8%	Xerox	Chairman executive committee
56	**Jerry R. Junkins/50**	685,000	37.0%	Texas Instruments	President, CEO
57	**Gordon E. Moore/59**	684,419	85.7%	Intel	Chairman
58	**Eugene R. White/56**	682,915	8.7%	Amdahl	Vice president
59	**John F. Mitchell/59**	679,575	33.2%	Motorola	President, director
60	**Marshall D. Butler/61**	679,000	175.7%	AVX	Chairman
61	**James L. Donald/55**	678,574	75.2%	DSC Communications	President, CEO
62	**Harold Falik/37**	678,100	NA	Emerson Radio	Senior VP
63	**Stanley A. Wainer/61**	670,000	21.8%	Wyle Laboratories	Chairman, CEO
64	**K.V. Cassani/59**	667,231	NA	IBM	Vice chairman
65	**Mark Shepherd Jr./65**	660,020	43.5%	Texas Instruments	Chairman
66	**Bernard S. Appel**	659,673	44.1%	Tandy	President Radio Shack div.
67	**Jack D. Kuehler/55**	656,126	23.5%	IBM	Vice chairman
68	**Thomas A. Vanderslice/56**	650,190	NA	Apollo	Chairman, CEO
69	**John F. Gribi/45**	650,000	140.7%	Compaq Computer	Senior VP finance, CFO
70	**Luther Nussbaum/45**	641,922	82.1%	Ashton-Tate	President, COO
71	**Albert A. Eisenstat/57**	640,000	60.8%	Apple Computer	Sr. VP, general counsel, secretary
72	**Frank A. Brand/63**	627,500	141.3%	M/A-COM	Senior VP, chief technical officer
73	**William G. Moore Jr./48**	624,077	-29.6%	Recognition Equipment	Chairman, president, CEO
74	**Sing C. Tien**	615,470	NA	Seagate Technology	Senior VP, Far East operations
75	**E. Joseph Zemke/47**	604,987	19.4%	Amdahl	President, COO, director
76	**Robert W. Galvin/65**	600,000	10.5%	Motorola	Chairman
77	**Michael S. Swavely**	600,000	NA	Compaq Computer	VP, sales & marketing
78	**Thomas F. Burke/58**	600,000	160.9%	M/A-COM	President, CEO, COO
79	**Frederick A. Krehbiel/45**	575,546	95.1%	Molex	Executive VP, president Molex Int'l
80	**Winston R. Wallin/62**	569,498	0.6%	Medtronic	Chairman, president, CEO
81	**John A. Rollwagen/47**	564,877	-9.2%	Cray Research	Chairman, CEO
82	**James F. McDonald/48**	559,225	-14.5%	Gould	Chairman, president, CEO
83	**A.J. Krowe/55**	557,408	NA	IBM	Executive VP
84	**James M. Eckhart/56**	555,000	96.6%	Compaq Computer	Senior VP corporate operations
85	**David A. Bossen/61**	543,000	6.7%	Measurex	President, CEO, director
86	**Roger W. Johnson/53**	542,375	23.2%	Western Digital	Chairman, president, CEO
87	**Walter F. Raab/63**	541,000	9.7%	AMP	Chairman, CEO, director
88	**George M. Scalise/54**	538,418	NA	Maxtor	President, CEO
89	**Donald J. Atwood/64**	538,000	NA	General Motors	President GM Hughes Electronics
90	**Donald Dvorkin/44**	537,500	NA	Emerson Radio	Executive VP
91	**Joseph T. Casey/56**	535,056	NA	Litton Industries	Executive VP, CFO, director
92	**William E. Terry/54**	533,013	24.4%	Hewlett-Packard	Executive VP, director
93	**Hollis L. Caswell**	527,140	NA	Unisys	Senior VP
94	**Charles M. Clough/59**	520,000	4.0%	Wyle Laboratories	President, COO
95	**Leslie L. Vadasz/51**	519,774	84.0%	Intel	Senior VP
96	**William E. Johnson/46**	514,482	NA	Scientific-Atlanta	Vice chairman, CEO
97	**James G. Treybig/47**	513,405	47.7%	Tandem Computers	President, CEO, director
98	**John J. Shields/57**	512,233	26.5%	Digital Equipment	Senior VP
99	**John F. Smith/52**	511,114	26.2%	Digital Equipment	Senior VP
100	**Joseph F. Caligiuri**	508,698	NA	Litton Industries	Executive VP

[3] became chairman April 1987, resigned as president
NA = Not available

Source: ELECTRONIC BUSINESS

ASIC strategies for the Big Five

The big five U.S. chip makers — TI, Motorola, Intel, National and AMD — have each developed a unique approach to the ASIC market

BY MICHAEL R. LEIBOWITZ

Until recently, conventional wisdom held that the "big five" U.S. chip makers had to become big players in a new business, and they had to do it fast. Application-specific integrated circuits were about to take over the integrated circuit business just as surely as ICs took over the transistor business in the 1970s. Equipment makers the world over were eliminating standard logic parts from new designs in favor of a few customized chips — ASICs — that incorporate much of the circuitry. In light of this, the warning to the big five was clear: Bring on ASIC capability or watch your businesses crumble.

Well, in case you haven't noticed, the top U.S. chip makers — Advanced Micro Devices Inc., Intel Corp., Motorola Inc., National Semiconductor Corp. and Texas Instruments Inc. — are doing quite well today without ASICs as a significant portion of their businesses. According to Scottsdale, Arizona-based Integrated Circuit Engineering Corp. (ICE), most of the five largest will have ASIC sales amounting to less than 4% of their total IC sales this year. "The major guys haven't been successful in ASICs," observes William McClean, an analyst with ICE. Despite this, they are enjoying a boom to rival any of the past booms.

Prosperity has brought a sigh of relief from the major U.S. chip makers — and the realization that, at least for the time being, they can indeed survive and thrive without ASICs. Wall Street, with its eye on profits, couldn't care less about the big chip makers' lack of success in ASICs. "It's not going to change earnings, perceptions or anyone's regard for a company in the next year or two," says Jack Geraghty, an analyst with First Boston Corp. Adds Michael Gumport, an analyst with Drexel Burnham Lambert Inc.: "ASICs are a niche in the overall scheme of things."

And with the pressure to become overnight ASIC leaders subsiding, chip makers are taking the hint. Within the last six months, both Intel and Motorola have closed their stand-alone ASIC operations. And Intel says it will end all gate array efforts. "We have shifted our focus," says Dave House, Intel's senior vice president and MCG general manager, explaining how the company is reallocating the resources necessary to build up a business in ASICs. "We're taking a fairly long-term view of this."

From interviews with each of the big five it is clear that no chip maker is abandoning its ASIC efforts. Each says it is continuing to develop ASIC tools and broaden ASIC capabilities. But gone is the urgency to offer ASICs to a broad cross-section of the customer base overnight — and the need to commit the great resources necessary to achieve this. The emphasis is now on supporting custom needs of the chip makers' biggest customers — the Fords and the General Motors, for example — the 20% or less that represent 80% or more of their business. And these will be the main beneficiaries of chip makers' ASIC activities over the next three years. The ability to support the ASIC needs of a wider swath of customers will occur gradually — sometime in the 1990s.

Several years ago, it was understandable to assume that chip makers would quickly have to play a major role in ASICs. After all, the business that was made possible by the advent of computer-aided design

Texas Instruments' Rhines: TI has aggressively built up a standard cell business

software in the early 1980s was growing by leaps and bounds. In 1984, three years after gate array pioneer LSI Logic Corp. shipped its first parts, ASIC makers shipped $920 million worth of parts in two main categories of ASICs, gate array and standard cell chips, according to ICE.

The main participants — ASIC houses such as LSI Logic, VLSI Technology Inc., NCR Microelectronics and a newly descended swarm of Japanese ASIC players such as Fujitsu Ltd., Toshiba Corp. and NEC Corp. — promised to make ASICs a big business. And they backed it by the capability to quickly turn around ASIC designs, excellent software tools and good support. Analysts, enthused by the prospect of an ASIC revolution, projected a $10 billion market by 1988. And by 1990, they expected ASICs to be a very profitable $20 billion business, usurping as much as half of the IC market. It was the direction in which logic was going. The chip makers had to be there.

Today, it's clear that these projections were wrong. Combined, gate arrays and standard cells will do about $4.2 billion this year, about $6 billion short of the mark. The biggest goof was in the area of standard cells — parts that use ultra-sophisticated software tools to produce a fully customized, denser chip. Instead of meeting analysts' projections of over $5 billion this year, the market for standard cell ICs will barely top $1.4 billion, according to ICE. It has been stunted by the absence of adequate cell libraries consisting of complex, high-performance cells — such as 16-bit and 32-bit microprocessors —and the lack of easy-to-use tools.

Gate array growth

But the lackluster growth of standard cells is only one part of the story. Gate arrays have indeed met sales projections. The gate array market will top $2.8 billion this year, by far the lion's share of the ASIC business. But for the most part, the production of these parts has become the kind of business that chip makers don't want to — or need to — be in.

Gate arrays, parts in which the chip maker customizes only the final layers of metallization that interconnect tens of thousands of gates, has turned into a cutthroat, commodity business. With 75 to 100 vendors offering similar products, prices are driven down and margins are squeezed. While there are some lucrative niches in the gate array business — Motorola, for example, reportedly is doing a thriving business in the high-speed emitter-coupled logic segment — the bulk of the gate array business, utilizing complementary metal-oxide semiconductor technology, has followed a ravaging path into commodity land.

The major firms have not abandoned R&D, but the urgency to offer a broad ASIC line is subsiding

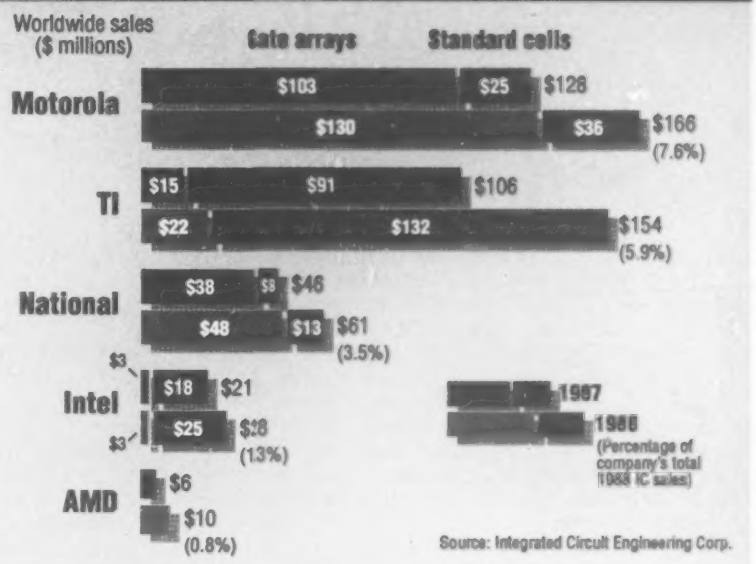
While gate arrays were becoming commodities over the past four years, the major U.S. chip makers were busy deemphasizing commodities and shifting their businesses toward proprietary, high-margin products. TI, for example, is said to have spent lavishly to design proprietary products in a number of lucrative, high-margin niches such as digital signal processing and grahics processing. National, too, is five years into a product transition that emphasizes proprietary products over the commodity "jellybeans" for which it established its reputation.

National says that about 40% of its business now is proprietary products. And TI executives say that half of their business is noncommodity chips. The entire industry, in fact, has seen remarkable results from its efforts to emphasize proprietary design and its efforts to protect exclusive designs from becoming multisourced commodities. Five years ago, points out Drew Peck, an analyst with Donaldson Lufkin Jenrette Inc., jellybean commodities generated 80% of U.S. semiconductor industry revenue and proprietary products produced the remaining 20%. Today, in contrast, commodities only represent 40% of the business. Proprietary products produce a whopping 60% of industry revenue. "It's flip-flopped dramatically," says Peck.

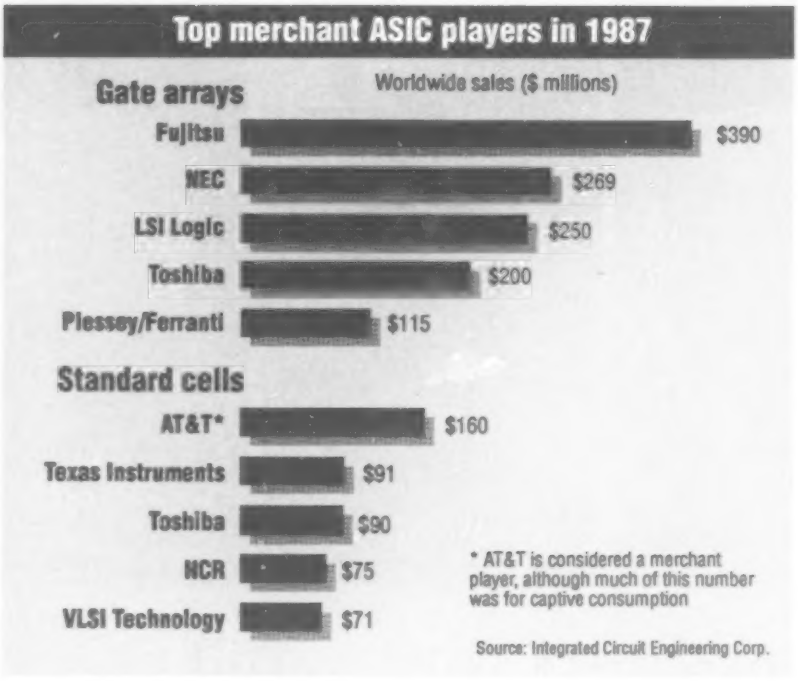
A haven from price erosion

The effect of this shift is that jellybean producers now have a haven from the low-profit commodity business — and a haven from the price erosion in gates and other commodities that the proliferation of gate arrays is causing. With this in mind, it's understandable that commodity gate arrays do not excite the major U.S. chip makers. Of the big five, only TI, National and Motorola offer CMOS gate arrays and of these, only

ASIC sales of the big five U.S. chip makers



Source: Integrated Circuit Engineering Corp.



one, National, appears to be placing any emphasis on them. TI's view is typical. Gate arrays are good for offering breadth to an ASIC line, says Wally Rhines, executive vice president of Texas Instruments' semiconductor group. Without breadth or "something really spectacular," says Rhines, "customers won't take the time to install your design tools and integrate you into their design environment." TI, he says, doesn't expect to become a leader in gate arrays.

But more than merely relieving the pressure to become gate array leaders, the industry-wide shift to proprietary products has reduced the need to become standard cell leaders as well. If customers require the complex functions offered by a proprietary chip, such as a 16-bit microprocessor or network controller, they have no choice in the matter. These functions are only available today as standard products. As Daniel Hutcheson, president of San Jose-based VLSI Research says: "Companies are differentiating their products in ways other than [by offering] ASICs." Intel's vice president, Dave House, puts it another way: "Our product is the Intel architecture." The implementations, as standard products or ASICs, are only "delivery mechanisms."

Of course, chip users will not always have just one "delivery mechanism" — standard products — available to them. Cell-based ASICs will eventually become a means of offering a vendor's complete portfolio of proprietary products. Eventually, libraries of cells will become the source of considerable competitive advantage for certain chip makers as they fill them with complex, proprietary cells such as 80386 and 68020 microprocessor cores, according to analyst Peck. Just as today, chip customers can only buy a 386 microprocessor from Intel, chances are that tomorrow, chip designers will only be able to do ASIC designs using an 80386 core if they are Intel ASIC customers.

Cell libraries will become the source of competitive advantage for chip makers

Each of the chip makers has taken the first step toward offering its products as ASICs by adopting a cell-based design methodology for designing new products. Cell-based design involves designing chip circuitry as modular building blocks, or cells. Once done, the chip maker can reuse the same cell in designing other standard products that need that particular function, say, a timer/counter or a microprocessor core. The cell can also become part of a standard cell library, which customers can use for their own ASIC designs.

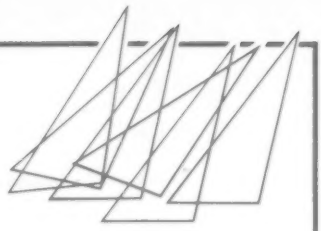
Deriving a competitive advantage

But it will be some time before the microprocessor leaders try to derive a competitive advantage in the ASIC marketplace from their cell libraries. Perhaps the biggest problem is that today's popular proprietary products were never designed to be incorporated into a cell library. And the task of converting these products to cells for a library is monumental, according to Dave House of Intel. In fact, Intel had scheduled to have products such as its 80186 16-bit microprocessor in its cell library by last January. It is still not ready. House now says that it would take all of Intel's engineers a year to convert its proprietary standard products to cells.

So far, cell libraries from companies such as Intel and Motorola contain nothing more complex than an 80C51 or 68C05 microcontroller — 8-bit processors useful for industrial control applications. Most of the other cells contained in the libraries of the major chip makers are small- and medium-scale integration (SSI and MSI) functions and a few peripheral circuits.

And despite offering considerable lip-service in the past to the idea of building up cell libraries, companies such as Intel and Motorola are not placing much emphasis on converting older products to cells. "If I felt that doing a standard cell library was my No. 1 priority, that's where I would have most of my resources," explains Tommy George, assistant general manager of Motorola's Semiconductor Products Sector. "But with our [standard] product portfolio, we don't view it that way."

For Intel, House says, the focus is not on placing past designs into its cell library, but on changing its methods so that new standard product designs can flow into the future-generation cell library, which will use 1-micron technology. Although Intel has a library using 1.5-micron technology, which may see the entry of some existing standard products,



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"We're not racing to boost that," says House. "The real emphasis is on the longer-term direction — and that's 1 micron. Products will be designed once and will automatically appear both as standard products and in standard cell libraries."

Bolstering today's anemic cell libraries is only one of the tasks that lay before the big five in making a future standard cell business. Chip makers must make their CAD software easier to use by customers. It is one thing for a chip maker's seasoned IC designers to use its tools, but quite another for customers — systems designers unsophisticated in the art of chip design — to use those tools. The tools need to be made "friendly" to the lay user, and they need to be better documented.

User-friendly tools

Today, their tools' lack of "user friendliness" and poor documentation presents a major support problem for chip makers. "Our tools have not been to the level that the customer could handle [the design] entirely himself," says House. Currently, he says, Intel must provide customers far more personalized support, or "handholding," than it would like.

The five top chip makers have dealt with this problem by keeping their lists of ASIC customers down to a relative few. Although none of the chip makers will reveal how many ASIC customers they currently have, each said it screens potential ASIC candidates based on the account's production volumes, its ability to complete the design with minimal support and its strategic importance to the chip maker. National, for example, wants to see capable customers with a minimum of $400,000 annual production runs of an ASIC, according to Jim Smaha, executive vice president of National's semiconductor group. National will go lower, he adds, for the right customer.

For those that qualify to be ASIC customers, the obvious tack is for chip makers to support them in using chip makers' CAD tools. In some cases, however, a chip maker will assign its own engineers to do the design in house. Advanced Micro Devices has the most exclusive ASIC strategy of all the big five. AMD will not place tools in customers' hands and has no intention of doing so, says Tony Holbrook, AMD's president. But the company will work with very large customers to make alterations to existing cell-based standard products, creating what it calls "customer-specific" ICs. "We are not a custom-house," says Holbrook emphatically. But, he says, "the ASIC need can be met in a number of ways."

Chip makers have been doing custom designs for their large customers for years — long before the advent of the term "ASIC," points out Motorola's George. And many of the big five continue to do these designs. The new cell-based software tools make the task of modifying existing standard products and developing new ones far simpler than before. But despite the fact that vendor-designed "ASICs" obviate the need for chip makers to adapt their tools for use by customers, this is not the long-term answer to the problem of providing ASICs to the marketplace.

Chip makers must make their CAD software easier to use by customers

Big customers want to use the tools themselves to create their own designs, says Motorola's George. This allows them full control over the design process — and the ability to keep more of their design proprietary. Agrees Intel's House: "The whole idea of ASIC is that customers do the design."

As such, the long-term ASIC strategies of the rest of the top chip makers must involve placing tools in customers' hands. Many analysts point to TI as the major company doing the best job in ASICs today. Certainly, with well over $100 million in standard cell sales, according to ICE, TI has more agressively pursued the task of building up a standard cell business than the others.

But the remaining four largest companies, and those with the hottest microprocessors, are taking it easy in ASICs. For now, you'll have to be an influential customer to get what you want in ASICs from the big five. They've got their hands full with standard products. □

How to survive and prosper in the ASIC world

As the ASIC marketplace grows, smaller companies are finding some very profitable niches, while challenging the limits of the present technology

BY JEFFREY BAIRSTOW

Despite the domination of the U.S. merchant semiconductor industry by the "big five" — Advanced Micro Devices Inc., Intel Corp., Motorola Inc., National Semiconductor Corp. and Texas Instruments Inc. — start-ups keep coming up faster than kudzu. Nowhere is this more true than for makers of application-specific integrated circuits. "The number of emerging technologies and new ideas means that the industry has not yet reached its mature stage," says Andrew Kessler, a senior industry analyst with PaineWebber Inc., New York City. Companies founded a few years ago, often by grizzled industry veterans, are just getting into their stride with novel ASIC products and are nipping at the ankles of the more well-established traditional ASIC vendors.

Indeed, the major suppliers of conventional gate arrays and standard cell devices, the two major classifications of ASICs, are continuing to experience high-growth years, but with severe price competition from the increasingly aggressive major Japanese semiconductor makers. However, the booming market for personal computers and their peripherals, in particular, is leading to lucrative opportunities for newer companies much smaller than the ASIC market leaders.

This year, the leader in the gate array market, that doesn't use a significant portion of its production in house, is expected to be LSI Logic Corp., Milpitas, Calif., according to Scott Hudson, an analyst with the market research firm Integrated Circuit Engineering Corp. (ICE), Scottsdale, Ariz. (Japanese leaders, such as Fujitsu Ltd. and NEC Corp., use about 40% for captive applications, says Hudson.) Founded in 1981, LSI Logic has produced some of the densest CMOS gate arrays with more than 50,000 usable gates. However, gate arrays are becoming more of a commodity business, notes Rodney Smith, president of Altera Corp., Santa Clara, Calif., a programmable gate array maker that has carved a profitable niche in that business. Consequently, he says, smaller companies cannot compete directly with large volume suppliers, such as LSI Logic or its Japanese competitors.

In the standard cell arena, the two leaders (after TI and Toshiba Corp.) are NCR Microelectronics, Colorado Springs, and VLSI Technology Inc. (VTI) of Santa Clara, says ICE's Hudson. ICE projects that NCR will do $94 million in CMOS standard cell devices and VTI will sell $80 million in 1988. Both companies have done well because they can offer substantial libraries of standard cells and have excellent suites of complex design tools. However, for smaller companies, the cost of providing such extensive libraries and sophisticated design tools is rapidly becoming prohibitive, to say nothing of the cost of building a wafer fabrication facility. Nonetheless, plenty of opportunity still exists, says PaineWebber's Kessler, for companies that are "adaptive to their customer's desires."

Although the big five have made some attempts to get into the ASIC business (see related story), the real action is among the little guys. The simple fact of the matter is that cus-

"We could grow faster," says Xilinx founder Bernard Vonderschmitt, "but we need [more] marketing support"

tomers will beat a path to the door of the outfit with a better mousetrap. "If you can provide the world with higher integration, lower cost and higher performance [smaller, cheaper, and faster], not only will more units be sold of current products, but new applications become feasible, creating markets never before in existence," says Kessler.

More responsive

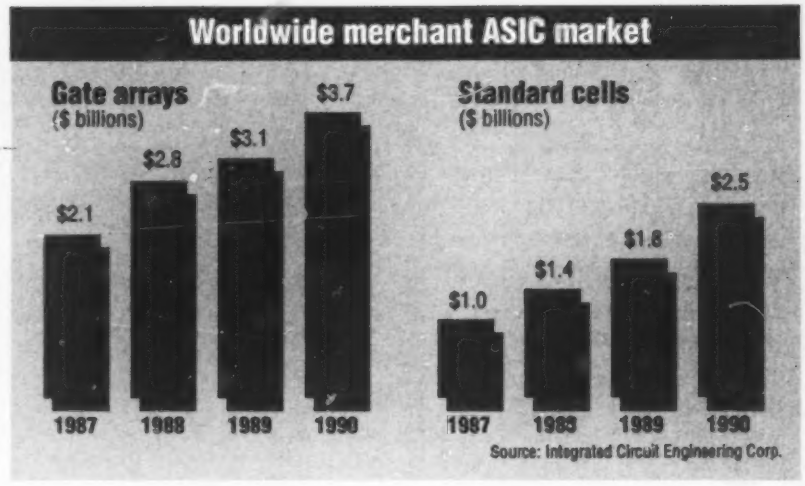
There are a few common threads running through the new successes of the ASIC field. Not only do these upstarts often have a lead on some new variant of semiconductor technology, but they are frequently led by battle-scarred veterans of the industry. Often, these are guys who implicitly understand both the technology and the no-holds-barred rules of a highly competitive business. They are also practiced scramblers who will doggedly chase a new market and adapt their products accordingly. And, these smaller players are often much more responsive to customer needs. Isn't that what application-specific means?

Take, for example, Xilinx Inc. of San Jose. Founded in 1984 by Bernard Vonderschmitt, the former general manager of Zilog and one-time general manager of RCA's solid-state circuit division, together with Ross Freeman, another Zilog graduate, the company has found a profitable niche in programmable gate arrays (PGAs), using its own patented architecture. Unlike conventional gate arrays, the Xilinx PGA's are programmed by the end user, rather than the gate array maker. The result is a standard part that can be programmed (and reprogrammed) at will by the end user with software that costs less than $5,000 and runs on an IBM PC AT or compatible system.

Xilinx's product offerings range from a 1,200-gate array, priced at under $8, to a recently announced 9,000-gate device that sells for $250. The technology is highly suitable and extremely cost effective for production volumes of under 25,000 per year, notes Vonderschmitt. Demand is strong for PGAs. "We expect around 8,000 gate array designs in 1988 with our PC-based development system, which will be about 40% of the total gate array designs this year," claims Vonderschmitt.

This year, the highly profitable Xilinx expects to do $30 million, according to Vonderschmitt. "We could grow faster," claims Vonderschmitt, "but we need to bring more horsepower to bear on marketing support and sales, for example." For now, at least, customers are flocking to Xilinx's door, mainly from the personal computer industry, where time horizons are incredibly short and the rate of product change remarkably rapid.

Even AMD, through its Monolithic Memories Inc. subsidiary, has taken note of Xilinx's success, says Vonderschmitt, and has licensed the PGA technology. Analysts expect the AMD deal to greatly expand the market for PGAs. "The task that lies ahead [for Xilinx] is to expand the market for the PGA by proliferating development systems — getting designers hooked — and then throwing new products at them as fast as they can handle them," says PaineWebber's Kessler.



Although the big five have attempted to get into ASICS, the real action is with the little guys

Lattice turnaround

At the lower end of the programmable logic device (PLD) market, Lattice Semiconductor Corp., of Hillsboro, Ore., appears to be turning around after several troubled years following its start in 1983. Now under the leadership of Norman Winningstad, the former founder and chairman of Floating Point Systems Inc., the manufacturer of high-speed array processors, Lattice is focusing its efforts on electrically erasable CMOS gate arrays that are direct replacements for Monolithic Memories programmed array logic (PAL) devices, but are faster and can be reprogrammed. The company expects sales of more than $12 million in 1988, according to Winningstad.

Lattice has also chosen the route of offering better performance than its competition, says Bill Smith, vice president for marketing. Lattice is the only supplier of 15-nanosecond programmable gate arrays, says Smith. The company has recently announced a 12-nanosecond product and expects to go to 10 nanoseconds very shortly, according to Smith. Consequently, Lattice products can compete with bipolar PLDs but offer comparable speeds at lower cost. Sales have been very strong in Japan, where "there are no electrically erasable PLD manufacturers and we can offer 100% testability, a feature the Japanese love," notes Smith.

The technology of erasable PLDs is being pushed even further by Altera Corp., with its Multiple Array Matrix (MAX), which will triple the density and double the performance compared with conventional PLDs in the same package sizes, according to David Laws, vice president for marketing for Altera. This means a PLD with 5,000 gates and system clock

speeds of up to 40 MHz. Altera's intention is to offer its new PLDs as alternatives to conventional TTL SSI and MSI parts. "One MAX device has the potential to replace 50 or more TTL packages," says Laws.

Altera was started in 1983, by Robert Hartmann, formerly with Signetics Corp.; James Sansbury, formerly with Hewlett-Packard Co., and Paul Newhagen, formerly with Fairchild Semiconductor Corp. The president, Rodney Smith, was general manager of the linear division of Fairchild. Thus, Altera also has a management team with considerable experience in the semiconductor industry. As with Xilinx, the strategy for Altera has been to offer a range of standard programmable parts with a relatively inexpensive set of development tools for the IBM PC AT that allow customers to design and program custom logic circuits themselves, notes Smith. Altera expects to do around $40 million in 1988, says Smith.

Although the basic premise of an ASIC company is usually to permit the customer to design chips to suit a particular application, the same design techniques can be used to produce complex standard parts for limited production. A case in point is Cirrus Logic Inc., of Milpitas, Calif. Cirrus Logic has developed a set of IC design tools for full custom standard cell designs which it not only offers to its customers but also uses internally to design some very successful products. For example, only six months after the announcement of the IBM PS/2 line of personal computers, Cirrus Logic had developed a VGA-compatible graphics processor chip that is also backward compatible with earlier graphics standards, such as CGA, EGA and Hercules.

That VGA part was the first on the market, by three to six months, according to Michael Hackworth, president of Cirrus Logic. In fact, this chip has found widespread use in many IBM clone machines and add-on graphics boards. Similarly, Cirrus has used its own design tools to produce a hard disk controller that can handle transfer rates as high as 20 megabits per second, without interleaving. According to the company, this chip will make possible a fast, half-height 20-megabyte hard disk for under $200. Not content with success in graphics and disk controllers, Cirrus is also offering a controller for laser printers that has the potential to double or even quadruple the speed of Postscript laser printers.

Altera's Rodney Smith: As gate arrays become a commodity product, it's more difficult for smaller firms to compete

This philosophy of using ASIC techniques to design custom chips that are then marketed by the ASIC company itself has been taken one step further by Integrated CMOS Systems Inc. (ICS), of Sunnyvale, Calif. ICS designs and manufactures custom chip sets and board-level products based on its own proprietary CMOS gate arrays. The principals of ICS, notably the president Lin Wu; vice president for engineering Laurence Cooke; and vice president for planning Symon Chang; are all "fugitives" from Storage Technology Corporation's Computer Research Corp., where they were involved in the design of IBM-compatible mainframe systems. ICS' focus is on midrange, high-performance computer manufacturers that are attempting to implement lower-cost redesigns of existing systems or higher-performance new designs, according to Tom Miller, vice president for sales and marketing for ICS.

New ASIC firms are finding niches with novel products

RISC chip sets

For ICS, the company's first big design hit is the recently announced Apollo DN 10000, a reduced instruction set computing workstation, which is based on a set of 10 30,000-gate CMOS gate arrays from ICS. "Our next design for Apollo will achieve the same power and performance with only five arrays," predicts Miller. Although the company will not give details, ICS is also working on similar chip sets for a U.S. mainframe computer maker and a Japanese minicomputer manufacturer.

While Cirrus Logic and ICS are both digital design companies, one ASIC company even offers a triple threat — digital technology, analog technology and electrically erasable PROM (programmable read-only memory) on the same chip. There are many applications, from automobiles to telecommunications, that require both analog and digital technology, which is typically provided by gate arrays together with analog chips and discrete components on a printed circuit board. Sierra has gone one step further by integrating three technologies on one device. Sierra's first product in this form is a 1200/2400 baud modem for Toshiba laptop computers. Clearly, Sierra believes in the better mousetrap theory.

Although much has been made of the general malaise affecting the U.S. semiconductor industry in recent years in the light of tough competition from Japan and the newly industrializing countries of the Pacific Rim, innovation continues, particularly in the smaller U.S. companies, notes PaineWebber's Kessler. "Innovation just does not quit in the semiconductor industry. Everyone is full of new ideas and most of the big companies do not have the resources to chase every possible idea," says Kessler. "In almost every case, new companies start with a base technology different from everyone else's and leverage this base through continued new product offerings." While most of the big five are sitting on their hands on ASICs, smaller startups are pushing the limits of technology and improving design techniques to the benefit of systems engineers both in the U.S. and overseas. □

Going public: To get the money, you gotta be great

The IPO market may appear robust, but investors are going only for quality companies with great financials — especially if they're software firms

BY RAY WISE

After having been nearly buried under last October's crash on Wall Street, the market for initial public offerings (IPOs) is alive and well. But it's as selective as a debutante's coming out party, so top executives of companies considering going public have some careful thinking to do.

About 15 or 20 ventures now go public monthly — mainly technology companies and closed-end investment funds — compared with only four or five per month right after the crash. And the batch of fledgling companies waiting in the wings is rumored to be large.

"The market for IPOs is very strong," says Terence Tehranian, an associate in the corporate finance department of Hambrecht & Quist Inc., San Francisco-based investment bankers. While the recent robustness contrasts sharply with late 1987 conditions, activity has not reached pre-crash levels, and only the better companies are coming out.

That point was proved recently at Index Technology Corp. The 5-year-old Cambridge, Massachusetts-based maker of computer-aided software engineering (CASE) tools impressed investors with its tight management controls and strong record of sales and profits growth — enough to pull in $19.2 million in IPO funds, $15 million of which went to finance growth and the rest to compensate early investors.

Dealings in IPOs, in fact, have undergone a quantum change since the heady summer of 1987, when the Dow topped 2,700 and companies were going public at twice the current rate. Some really did not qualify as freestanding ventures. "We saw too many companies that were too small, too inexperienced and did not have broad enough product lines," recalls Roy C. McKay, vice president of Scudder, Stevens & Clark, a Boston investment brokerage. "Some of them would have made good little divisions of other companies."

Not so these days. "There is a demand for quality," says Barry Gordon, president of the American Fund Advisors (AFA) group of technology-dominated mutual funds in New York. The only kinds of companies that are coddled in the current IPO market are those that are well established and can boast impeccable financial credentials, or are firmly positioned in a swiftly growing sector like cellular radios.

Managements mulling a maiden stock offering in this environment are advised to proceed cautiously. "If you are not really ready to go public, you won't be able to raise the money you need," Gordon cautions. "Better stay private awhile. There is plenty of venture capital out there." "There is no shortage of capital, only a shortage of good companies to invest it in," adds McKay.

To sort out companies that are ready to go public from those that aren't, Katherine R. Kirk, a principal in the Boston office of Hambrecht & Quist, uses three criteria: profitability, competitiveness of the product line and depth and breadth of management. Kirk wants an emerging venture to have posted four back-to-back quarters of profitability and to offer good profits prospects in the next four quarters too.

Industry sector is another factor that can influence an IPO's outcome. "The three sectors that are best received by the investing public are software, software and software," says Kirk. Software companies have

"Our IPO gives us credibility with our customers," says Burt Rubenstein, Index Technology's research vice president

Dave Bradley

dominated new offerings in the last few months — companies like database management firm Relational Technology Inc. — but there have been a few hardware firms too, such as 3.5-inch hard disk drive maker Conner Peripherals Inc. and graphics products maker Sigma Designs Inc.

Fussy Wall Street

Reflecting market fastidiousness, some companies have launched their stocks at prices so moderate by historical standards as to lure institutional investors, some of which usually shun new issues.

A stock making its debut in today's market is likely to be priced at the low end of the range targeted for it by the investment bankers, even though it may have emerged at the top of its range last summer. In terms of the stock price/corporate earnings multiple, ventures that would have commanded a multiple of two or three times that of the market are coming out right on the market, or at a slim premium — 20%, or at most 30%.

Another symptom of the investing public's skepticism is that the discounts imposed on new issues, relative to established stocks in the same industry sectors, have widened to around 15% from the usual 5% or so.

Although demand for IPOs is strong upon launch, many of the buyers who snap them up sell them at once for quick profit. The "flipping" can cause an entire issue to trade within a few days of its introduction.

"This is a totally unforgiving market," notes the AFA's Gordon. A company expected to post quarterly earnings of 10 cents a share that actually reports eight cents, can watch in horror while its share price skids 50%. Technology stocks are especially vulnerable to investor intolerance or outright caprice. This shabby treatment does not even spare the bigger names, as was demonstrated a while back when Microsoft Corp.'s shares tumbled 15 points to 52 in 17 days, for no apparent reason. "There was no negative news," reports one portfolio manager.

One factor that newly arrived shares have going for them is their pricing, which recently has been highly attractive from the investor's viewpoint. The awesome power of the discount showed up clearly in the first six months of 1988, when the performance of the neophyte shares soundly trounced that of the stock market at large. In fact, Standard & Poor's index of 80 recently emerged stocks gained more than 25%, compared with under 11% for S&P's mainstream 500-stock index.

Who went public in 1988

A sampling of 1988 electronics IPOs, $10 million and up

Issuer	Deal size ($ thousands)	Offering date
Octel Communications	$14,700	2/26/88
Maxim Integrated Products	11,000	2/29/88
Vitalink Communications	16,500	3/4/88
Altera	22,000	3/30/88
Conner Peripherals	32,000	4/12/88
Contel Cellular	85,000	4/21/88
Relational Technology	28,000	5/17/88
Phoenix Technologies	49,500	6/14/88
Dell Computer	29,800	6/22/88
Index Technology	19,200	6/23/88

Source: Hambrecht & Quist Inc.

"Eleven of the 20 best-performing stocks in the new issues index were technology shares," notes Robert Natale, senior investment officer of Standard & Poor's Corp. In addition, the second-best performer in the top 20 was Octel Communications Corp., which is a marketer of voice-processing equipment, that surged more than 105% in the 6-month span.

"The three sectors best received by investors are software, software and software"

Index Technology, one of Kirk's clients, went public last June, raising $15 million to finance growth in CASE. The stock offering was backed by strong financials, with operating earnings per share up 25% on revenue growth of 45% last year.

Big Blue's blessing

The company had spun off from a consulting firm in October 1983, its start-up bankrolled largely by the parent organization. Index Technology signed a distribution agreement with IBM in January 1984. The move was "more for the blessing of Big Blue than for revenue growth," explains Chris M. Grejtak, vice president for marketing and sales.

Management carefully nurtured the growth of Index Technology by pursuing highly specific corporate objectives, especially in financial controls. When revenue projections failed to materialize, manpower expansion and new projects were scaled back accordingly; but when revenue surpassed expectations, deferred spending programs were wheeled out.

Venture capital was infused into Index Technology to the tune of $2.75 million in 1984 and $2 million in 1985, and the result was vigorous corporate expansion. Revenue surged from $1.7 million in 1984 to $22 million in 1987, while the payroll grew from 48 to 186.

This forced the management team to confront three options: stay private and continue to raise capital internally and through venture capitalists; seek to be acquired by a company with deeper pockets; or go public. Marketing chief Gretjak points out that Index Technology was blessed with having venture capitalists who did not try to push the company out into a premature IPO to turn a swift profit on their investment.

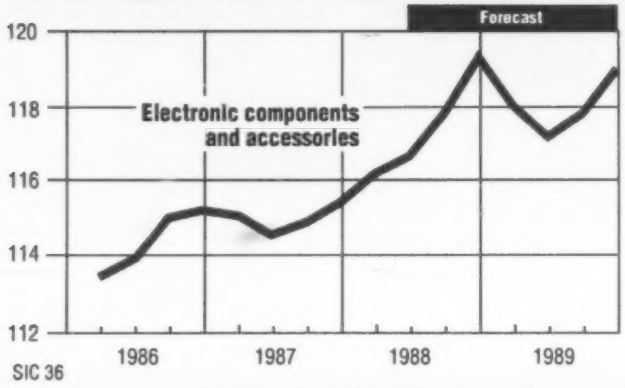
But timing is everything in an IPO. Scudder's McKay advises coming out in late fall or early winter because demand for new issues on the stock market tends to be highest in January and lowest in August.

Some participants say it's more subjective. "You are ready to go public when it 'feels' right," says Index Technology's Gretjak. "We had had a strong 1986, and 1987 was particularly strong, and at the end of 1987 prospects for the next quarter looked very good." Quarterback for the IPO was CFO J. Jeffrey Bingenheimer, and Gretjak advises other emerging companies to copy this one-person policy. "One person definitely should manage the process of going public," he says.

IPOs bring other advantages —like more capital, according to Burt L. Rubenstein, Index Technology's vice president for research and technology. He says: "It gives us credibility with our customers as a long-term company with financial strength." □

Producer price index — Electronic components

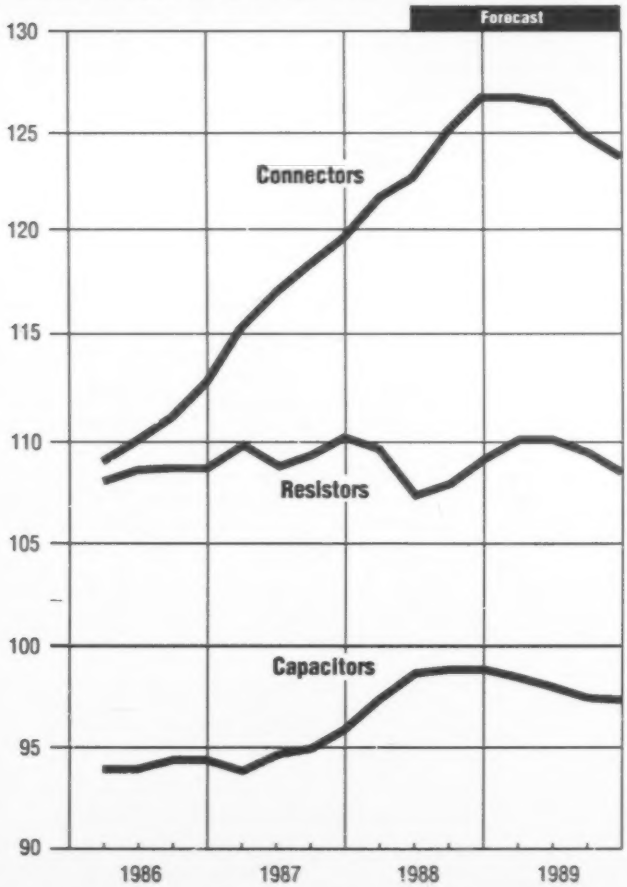
Quarterly averages, 1st quarter 1982 = 100



Historical data: Bureau of Labor Statistics; Forecast: Cahners Economics

Producer price indexes — Passive components

Quarterly averages, 1st quarter 1982 = 100



Historical data: Bureau of Labor Statistics; Forecast: Cahners Economics

Passive prices mixed bag so far in 1988

Prices of capacitors and connectors jumped over 4% in the second quarter of 1988 compared with a year earlier. This spring surge was not met by similar price increases for resistors; those prices dropped 1.3% in the second quarter. All in all, passive component prices, as measured by the Bureau of Labor Statistics, showed only a mixed bag in the passive price arena.

Monthly surveys of buyers made by *Electronics Purchasing* magazine suggest that passive prices have little upward pressure due to any supply-demand imbalances. According to the magazine's survey, this past summer buyers waited just about the same length of time for deliveries of connectors, capacitors and resistors as they waited a year ago. Compared with the last period that delivery times stretched with supply shortages in 1984, connector delivery times are a week shorter, resistors remain a week and a half shorter, and capacitors are two and a half weeks below 1984 summer schedules.

Inflationary expectations?

Rather than the economics of supply and demand, inflationary expectations are probably playing a bigger role in 1988's passives price picture. The summer drought which boosted Midwest produce prices could have an inflationary effect, eventually, on all electronic component prices.

That may seem like a long leap of faith from the farm to the electronics factory, but as consumer expectations of inflation rise, demand for higher wages heats up, and employers of manufacturing production workers end up passing the higher wage prices along to their buyers of components and machinery. And on it goes, creating a spiral of higher and higher inflation.

What are the chances that such an inflationary spiral will take place in late 1988 or 1989? Given the Federal Reserve Board's determination to hold inflation in check, there remains a lot of doubt that prices will see action like 1981 after the oil prices took off. Still, buyers and sellers of electronic components need to look at inflationary expectations in the whole economy, not just the electronics industry.

ELIZABETH BAATZ

Computer industry on top again

From May to June, new orders of computers and office machinery pushed up almost 4% to $5.6 billion. This is the highest monthly level since February 1985. The June figure brings first half new orders to $33 billion, an increase of 20% compared with the first six months of last year. Sales growth continues unabated. Shipments tallied $5.7 billion in June, a rise of 4% from May.

Industrial production of computer and office machinery in June dwindled less than half a percent from the strong May performance. The solid June figure brings the average second-quarter production 12% above the April through June period last year.

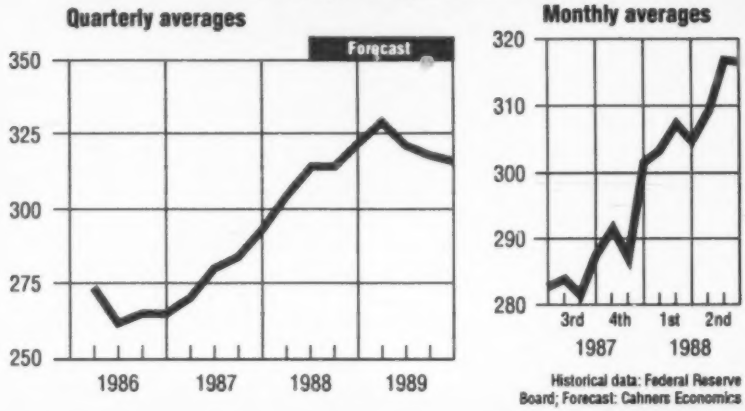
A good deal of this production is moving overseas. Through the first half of this year, computer and office machinery exports soared to $11.3 billion, a rise of 30% compared with the six months of 1987.

Computer makers continue to get a boost from domestic equipment investment spending. During the second quarter, businesses spent an annualized $40.8 billion (current dollars) for computers and office equipment, up a whopping 18% compared with the second quarter of 1987.

More information can be obtained from Madeline Franchi, senior economist, Cahners Economics, 275 Washington St., Newton, Mass. 02158. Phone: (617)964-3030.

Computers and office machinery — Industrial production

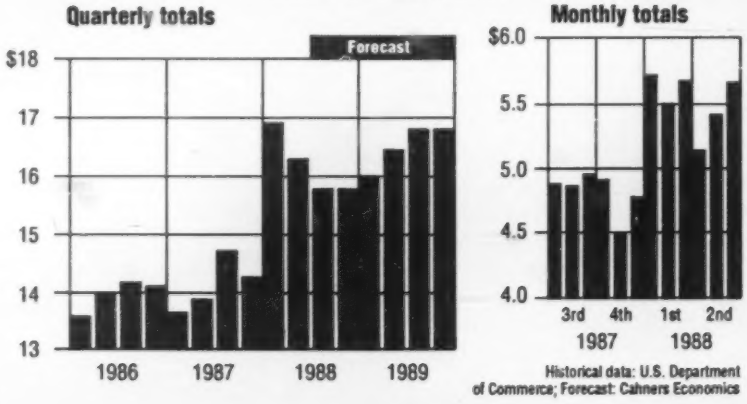
Seasonally adjusted index, 1977 = 100



Historical data: Federal Reserve Board; Forecast: Cahners Economics

Computers and office machinery — Shipments

Seasonally adjusted ($ billions)



Historical data: U.S. Department of Commerce; Forecast: Cahners Economics

Computer market database

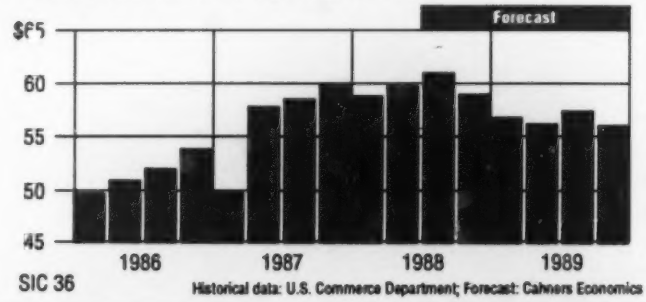
	Latest month	Previous month	Change	Year ago	Change	Next year	Change
Industrial production (SA,1977=100, June)	316.8	317.2	-0.13%	283.3	+11.82%	322.5	+1.80%
Shipments (SA, $ millions, June)	$5,683	$5,442	+4.43%	$4,578	+24.14%	$5,497	-3.27%
New orders (SA, $ millions, June)	$5,620	$5,410	+3.88%	$4,562	+23.19%	$5,482	-2.45%
Unfilled orders (SA, $ millions, June)	$18,661	$18,724	-0.34%	$19,152	-2.56%	$18,133	-2.83%
Inventory-to-shipment ratio (SA, June)	1.85	1.89	—	2.11	—	1.88	—
All employees (thousands, June)	514.8	507.2	+1.50%	483.6	+6.41%	518.3	+0.69%
Production workers (thousands, June)	168.8	167.9	+0.54%	161.8	+4.33%	166.3	-1.51%
Exports ($ millions, June)	$1,935	$1,842	+5.03%	$1,587	+21.93%	$1,992	+2.96%
Imports ($ millions, June)	$2,035	$1,773	+14.80%	$1,574	+29.28%	$2,019	-0.80%

SA = seasonally adjusted, all other data is not seasonally adjusted

Data sources: Federal Reserve Board, U.S. Bureau of the Census and U.S. Bureau of Labor Statistics
All data for SIC 357, except industrial production, SIC 357-9. Forecasts: Cahners Economics

Electrical machinery — New orders

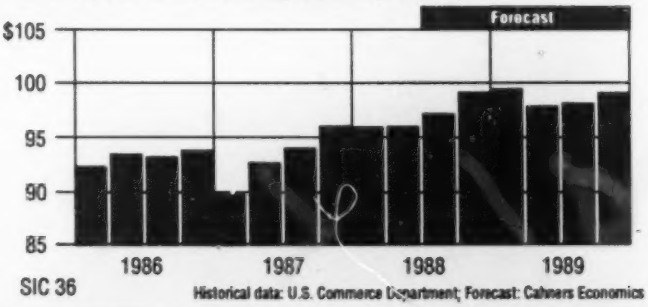
Quarterly totals, seasonally adjusted ($ billions)



SIC 36 Historical data: U.S. Commerce Department; Forecast: Cahners Economics

Electrical machinery — Unfilled orders

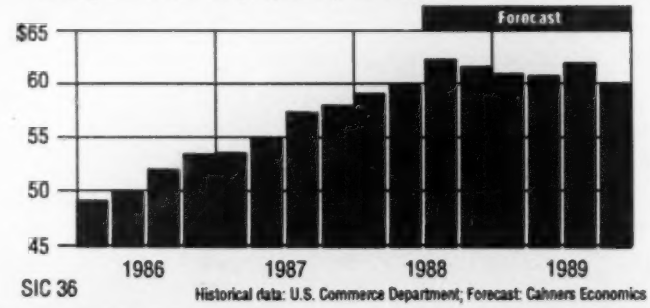
End-of-quarter totals, seasonally adjusted ($ billions)



SIC 36 Historical data: U.S. Commerce Department; Forecast: Cahners Economics

Electrical machinery — Shipments

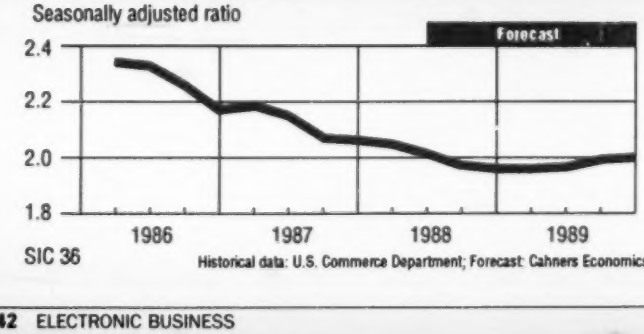
Quarterly totals, seasonally adjusted ($ billions)



SIC 36 Historical data: U.S. Commerce Department; Forecast: Cahners Economics

Electrical machinery — Inventory-to-shipments

Seasonally adjusted ratio



SIC 36 Historical data: U.S. Commerce Department; Forecast: Cahners Economics

Warning signals flash for electrical machinery

Second quarter data for the electrical machinery industry has flashed a warning signal: Back orders fell $57 million from the first quarter to the second quarter. Although this drop is an extremely small share of the total $96.1 billion of back orders, the decline was the first one in the past seven quarters.

The reason back orders have fallen: new orders have not continued to outpace shipments. Even though new orders rose 1.5% and shipments inched up 1.4% from the first quarter of 1988 to the second, orders totaled $59.77 billion, just shy of the $59.83 billion of equipment that was shipped. As a result, the book-to-bill ratio for this industry remains just below the critical 1.0 level.

These warning signals so early in 1988 do suggest that electrical and electronic equipment shipments will see a slowdown in 1989. Cahners Economics' forecast for shipments shows only a 0.4% gain in 1989 after an 8.2% jump in 1988. This forecast is probably one of the most pessimistic for the industry.

. . . But some green lights still glowing

Two factors could help push 1989 growth higher than Cahners' forecast. First, inventories relative to shipments remain extraordinarily low. Just-in-time inventory policies and management's concern about the continued buoyancy of this economic recovery have kept inventory in check. Without excess inventory, tomorrow's economic slowdown will positively not result in anything resembling an economic crash. And that is very encouraging news.

Second, the export market will continue to boost U.S. shipments next year. The impact of a lower dollar and cheaper U.S. goods abroad has taken a long time to be felt, so 1989 is expected to be another solid year for exporters.

The so-called "electrical" machinery industry is a broad collection of different industries. So far, the winners in the 1988 shipments race are electronic components and communication equipment, which together make up over 50% of the total electrical machinery industry. Placing second is electrical transmission and distribution equipment and miscellaneous electrical equipment. In last place with declining shipments is radio and TV, and household appliances.

ELIZABETH BAATZ